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(12) **United States Patent**  
**Beber et al.**

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(45) **Date of Patent:** **\*May 18, 2021**

(54) **FOOD PROCESSOR WITH ADJUSTABLE  
BLADE ASSEMBLY**

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(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.  
  
This patent is subject to a terminal dis-  
claimer.

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US 2020/0001490 A1 Jan. 2, 2020

**Related U.S. Application Data**

(60) Continuation of application No. 15/370,434, filed on  
Dec. 6, 2016, now Pat. No. 10,449,685, which is a  
(Continued)

(51) **Int. Cl.**  
**B26D 7/26** (2006.01)  
**A47J 43/07** (2006.01)

(Continued)

(52) **U.S. Cl.**  
CPC ..... **B26D 7/2628** (2013.01); **A47J 43/046**  
(2013.01); **A47J 43/0722** (2013.01); **B26D**  
**1/29** (2013.01); **B26D 7/01** (2013.01)

(58) **Field of Classification Search**  
CPC ... **A47J 43/0722**; **A47J 43/046**; **B26D 7/2628**;  
**B26D 7/01**; **B26D 1/29**  
(Continued)

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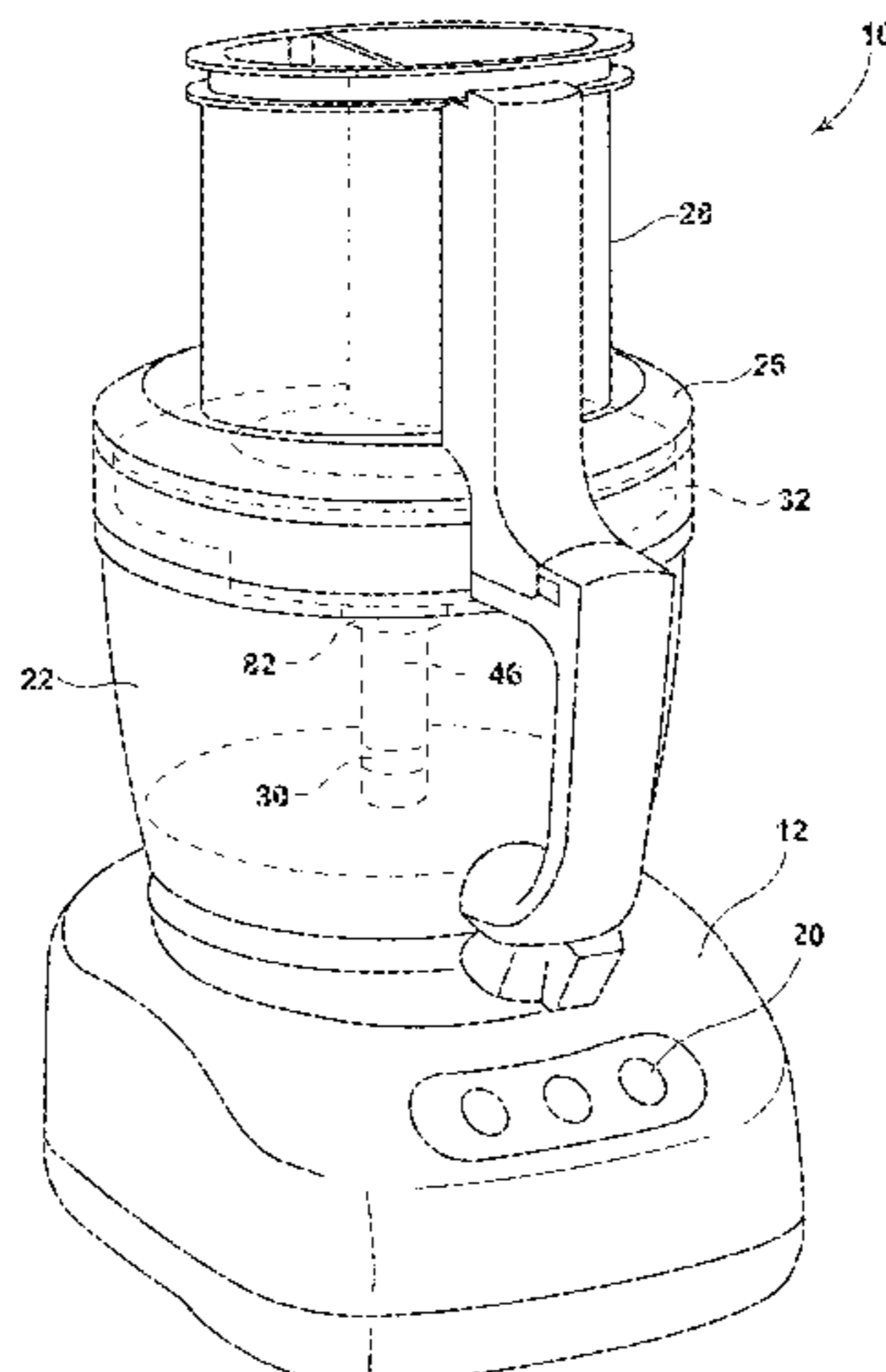
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(57) **ABSTRACT**

A food processor includes a bowl with a removable lid. Food  
items are advanced into the bowl through a feed tube formed  
in the lid where they are cut by a blade assembly. A rotating  
disk is adjustable relative to the blade assembly to vary the  
thickness of the food items cut by the blade assembly.

**21 Claims, 41 Drawing Sheets**



**Related U.S. Application Data**

continuation-in-part of application No. 14/220,203, filed on Mar. 20, 2014, now Pat. No. 10,105,864, which is a division of application No. 12/769,746, filed on Apr. 29, 2010, now Pat. No. 8,720,325, said application No. 15/370,434 is a continuation-in-part of application No. 15/000,712, filed on Jan. 19, 2016, now Pat. No. 10,582,808, which is a division of application No. 14/000,416, filed as application No. PCT/CN2011/001487 on Sep. 1, 2011, now Pat. No. 9,265,381, said application No. 15/370,434 is a continuation-in-part of application No. 14/000,413, filed as application No. PCT/CN2011/000311 on Feb. 25, 2011, now Pat. No. 9,655,474.

(51) **Int. Cl.**

*B26D 1/29* (2006.01)  
*A47J 43/046* (2006.01)  
*B26D 7/01* (2006.01)

(58) **Field of Classification Search**

USPC ..... 99/348, 537, 538; 241/92, 100, 277, 241/282.1, 282.2, 37.5, 278.1, 286  
 See application file for complete search history.

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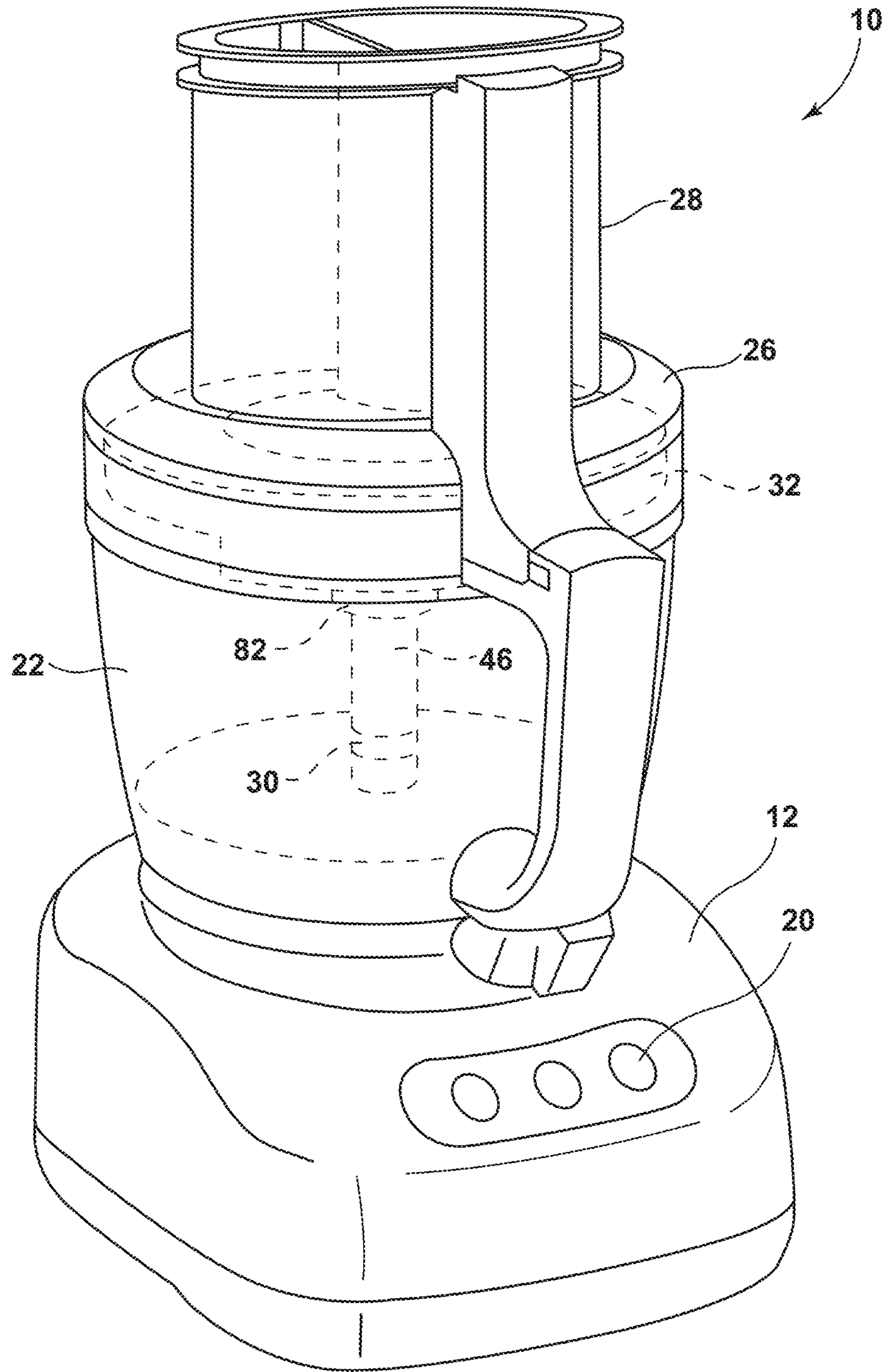


FIG. 1

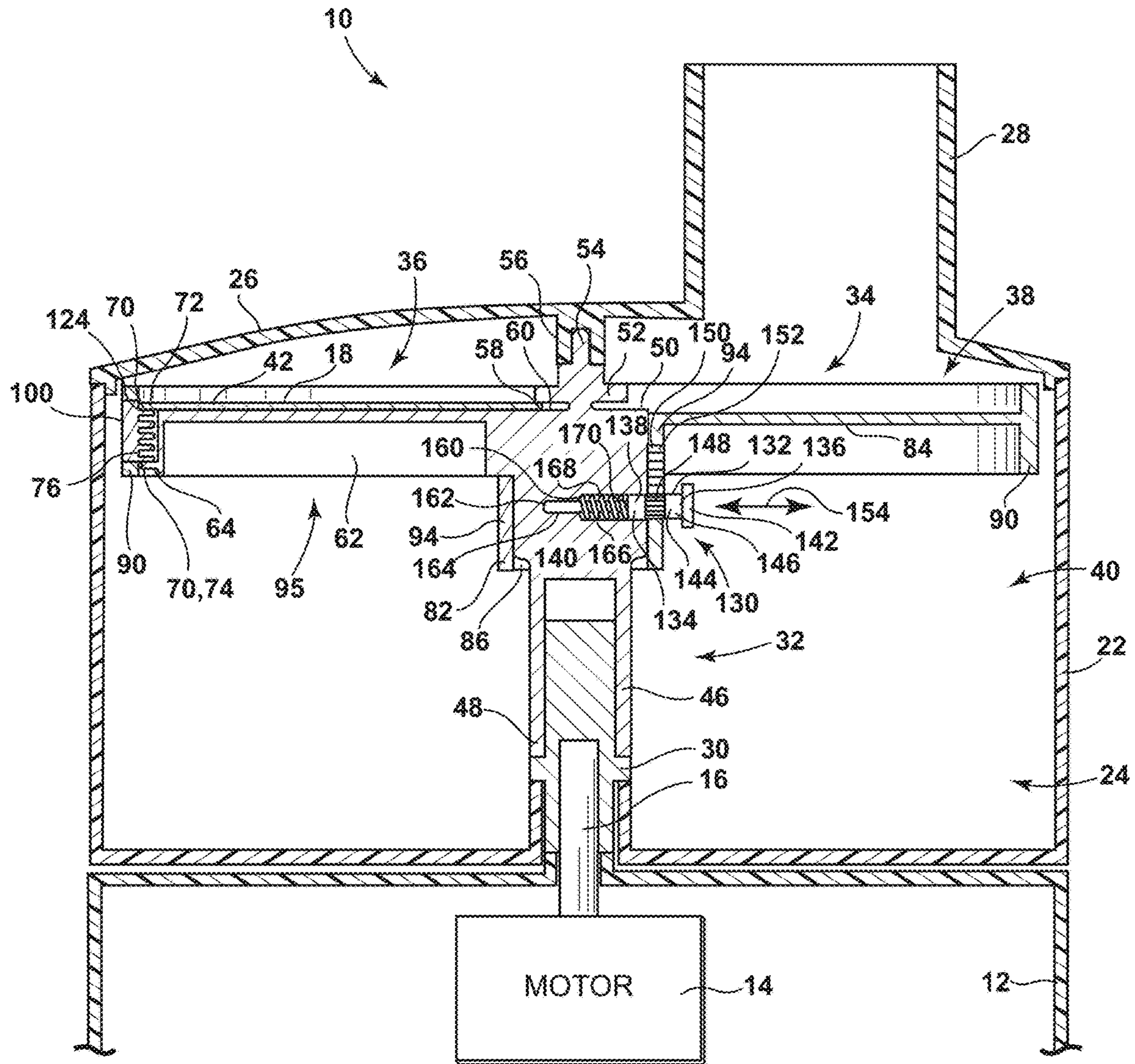


FIG. 2

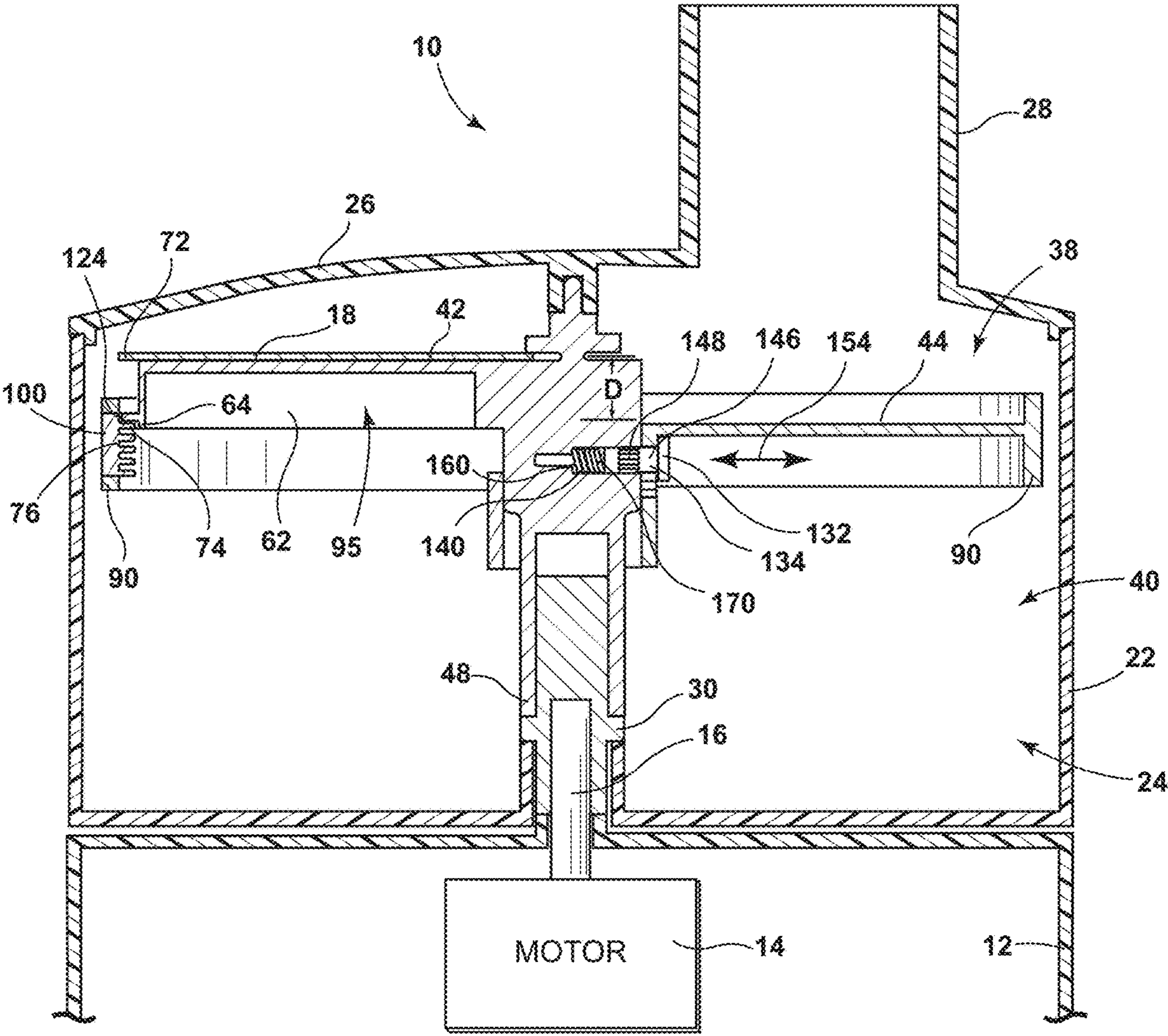


FIG. 3

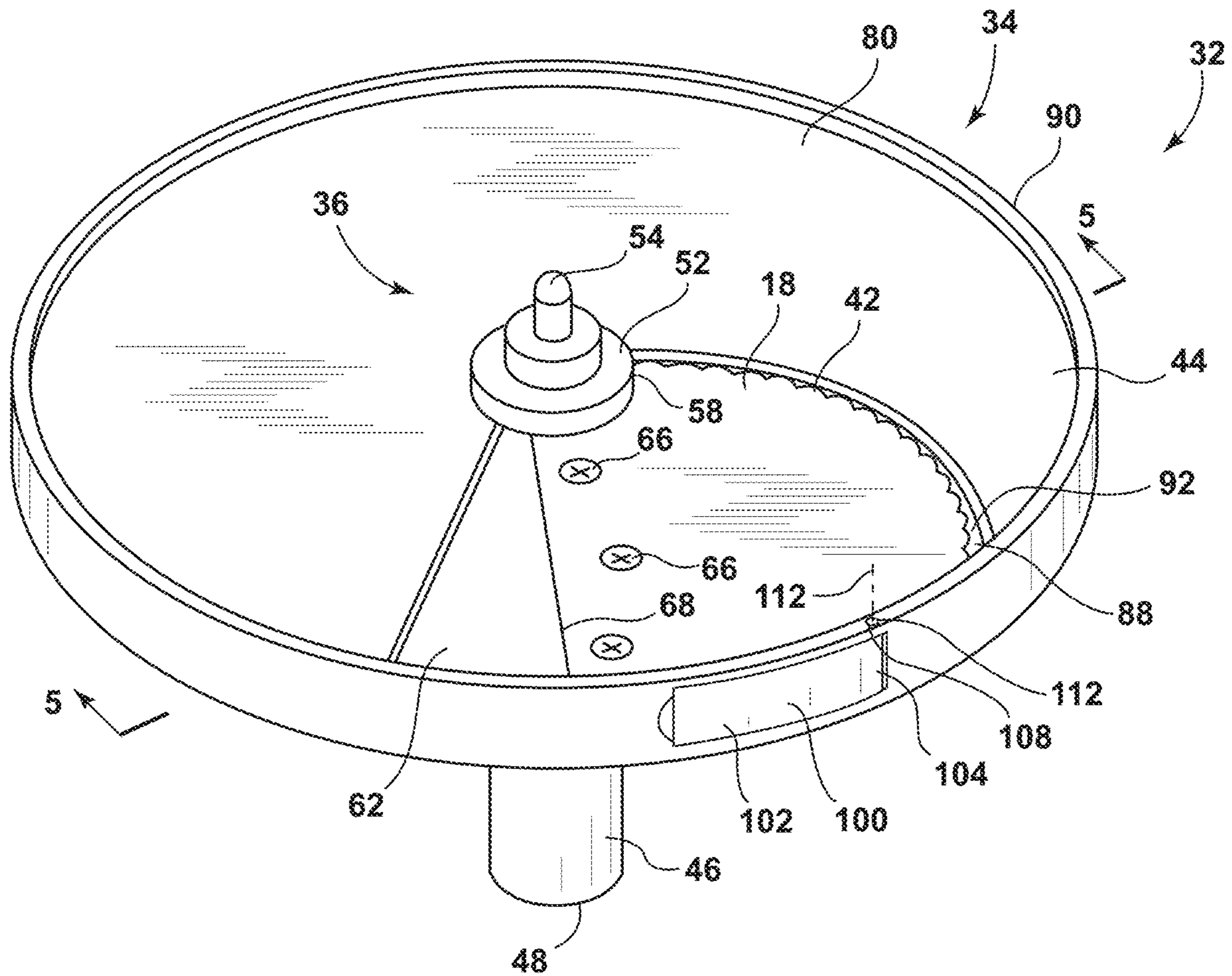


FIG. 4

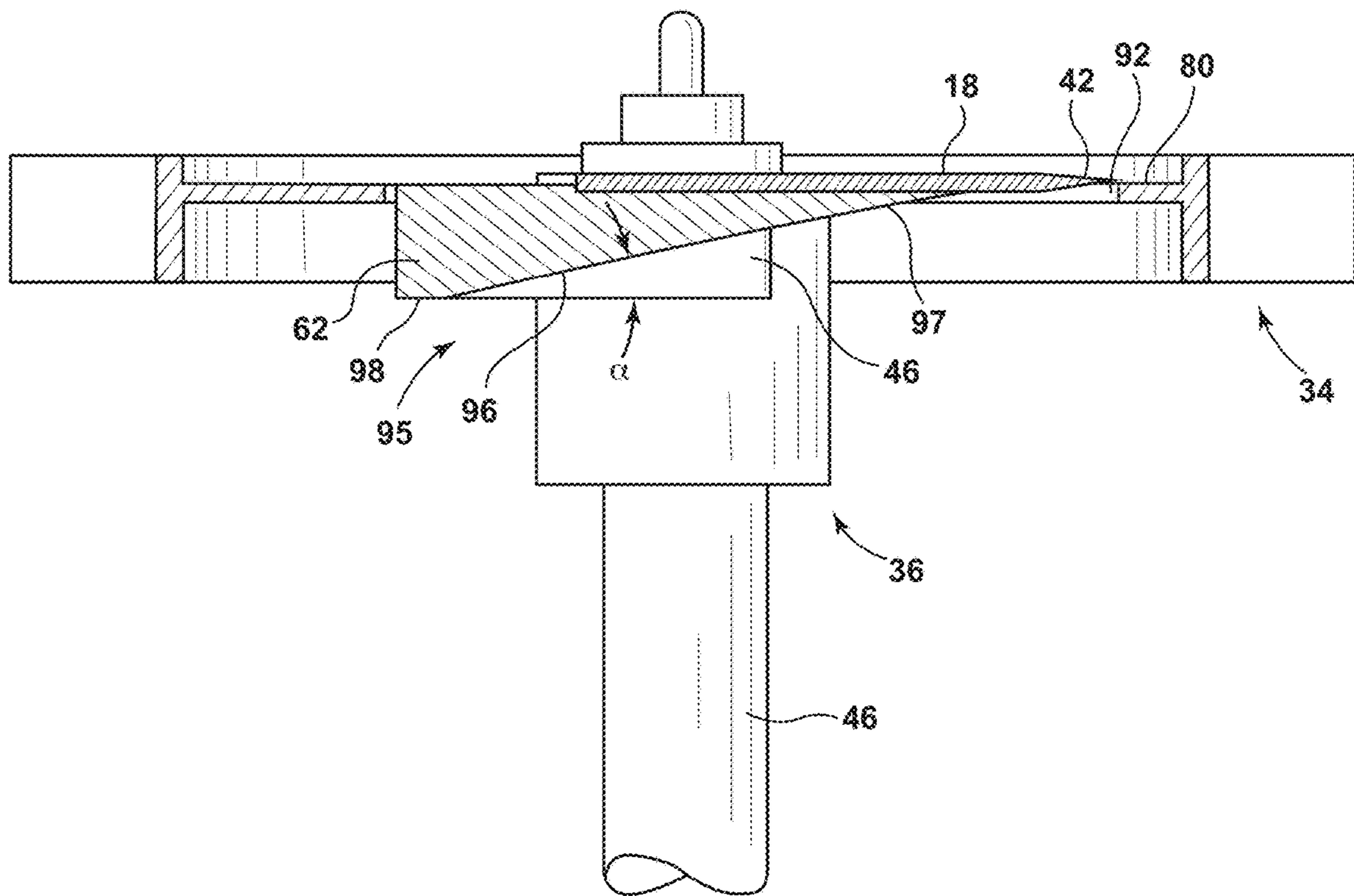


FIG. 5

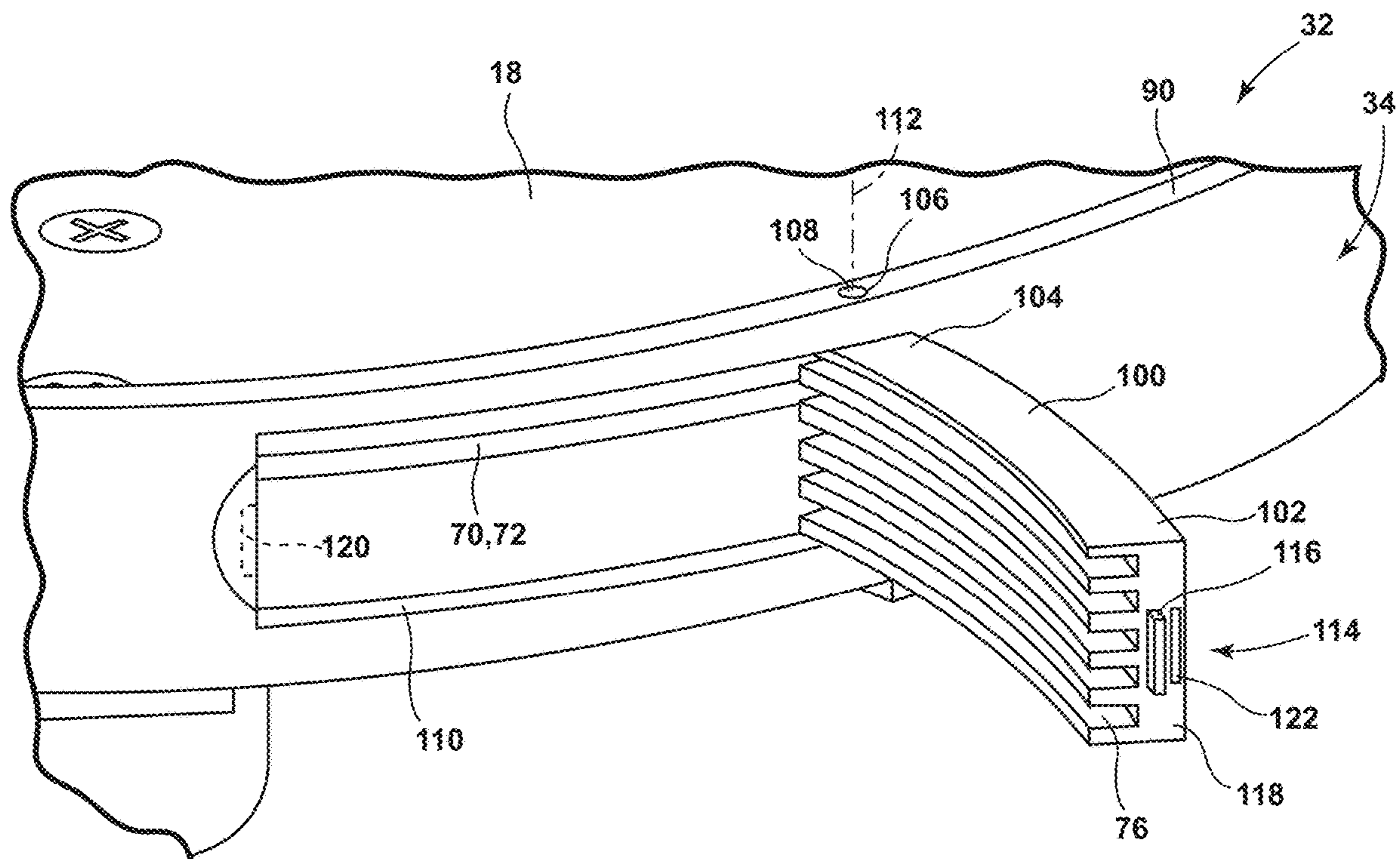


FIG. 6



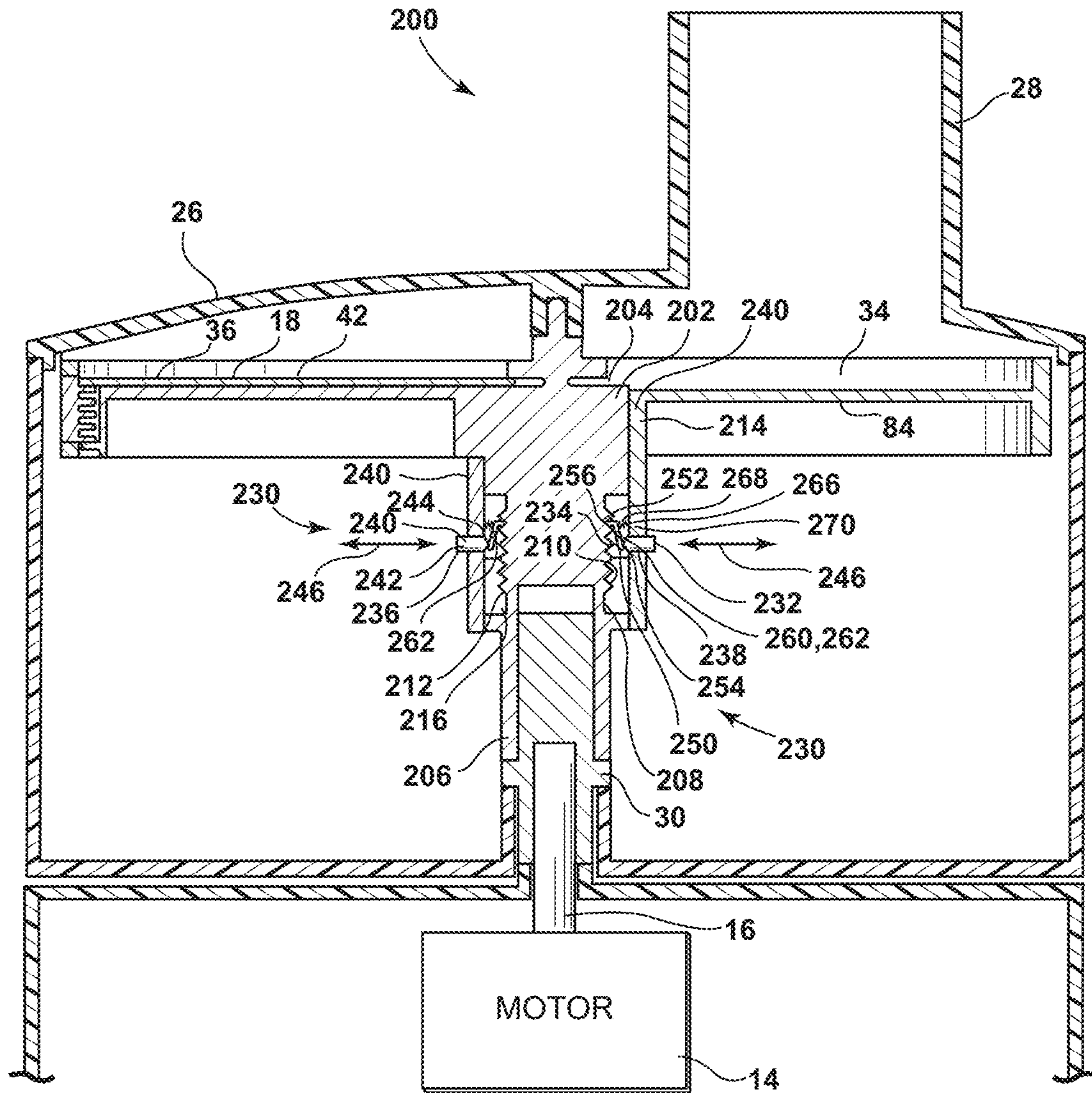


FIG. 7

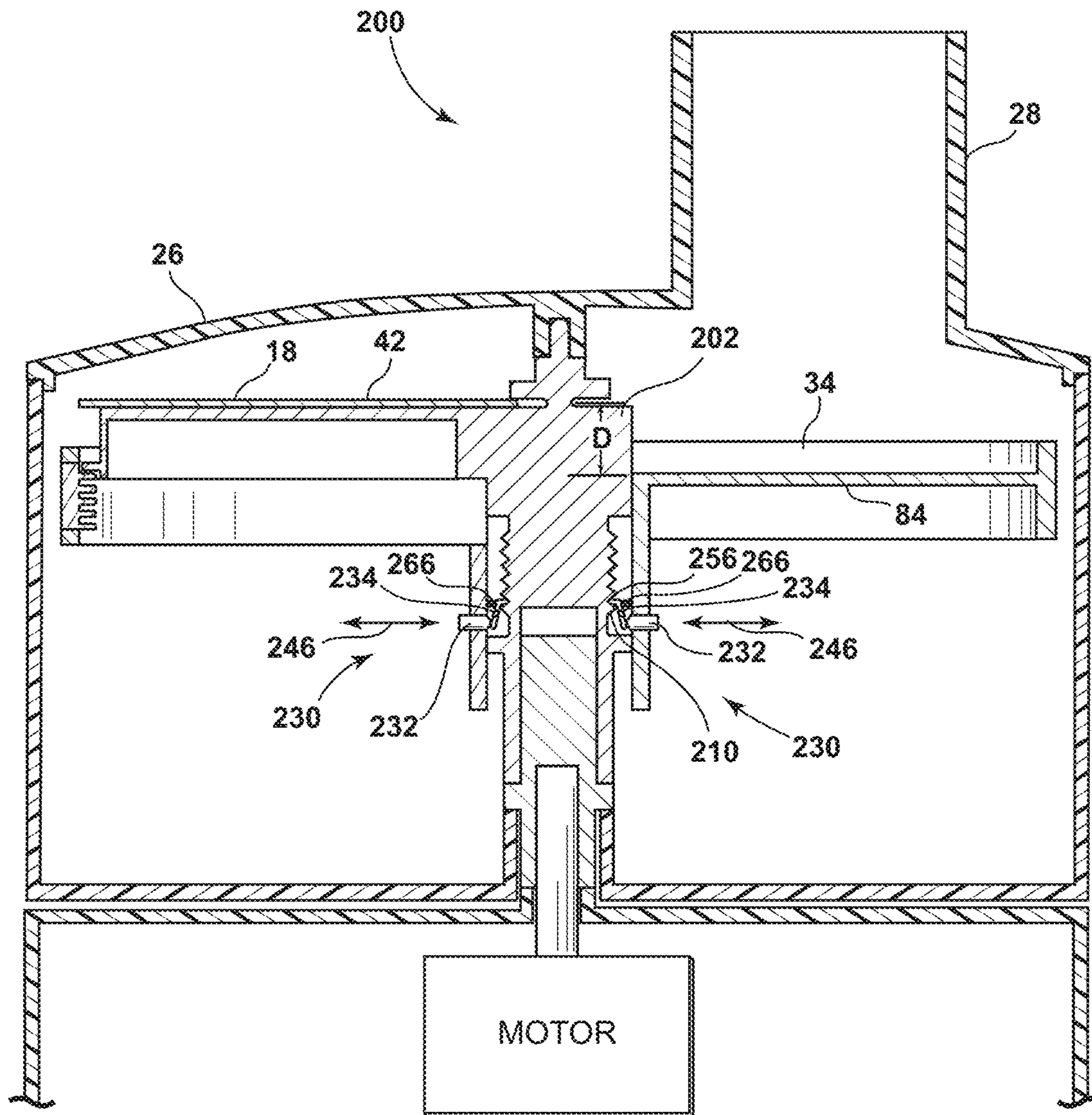


FIG. 8

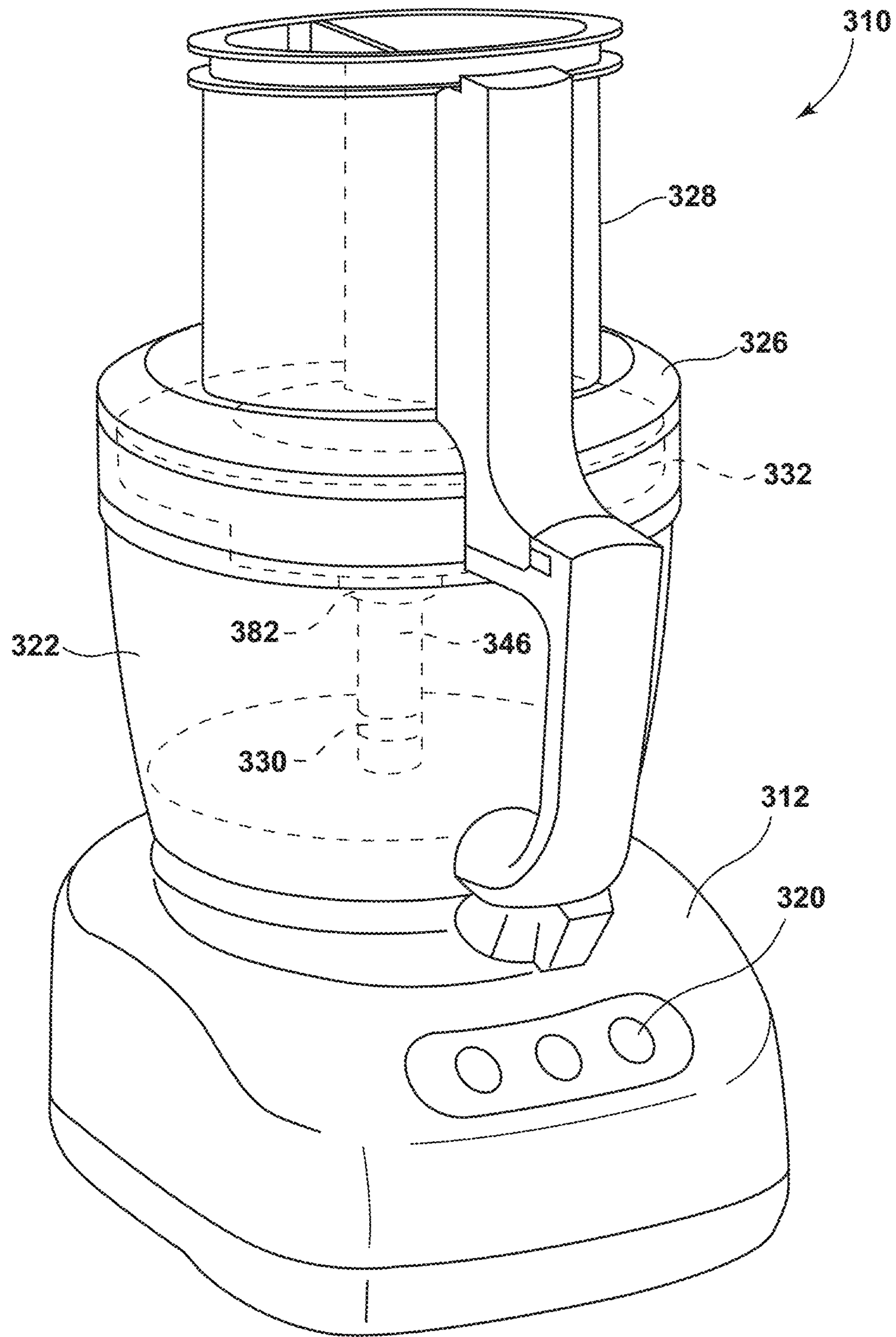


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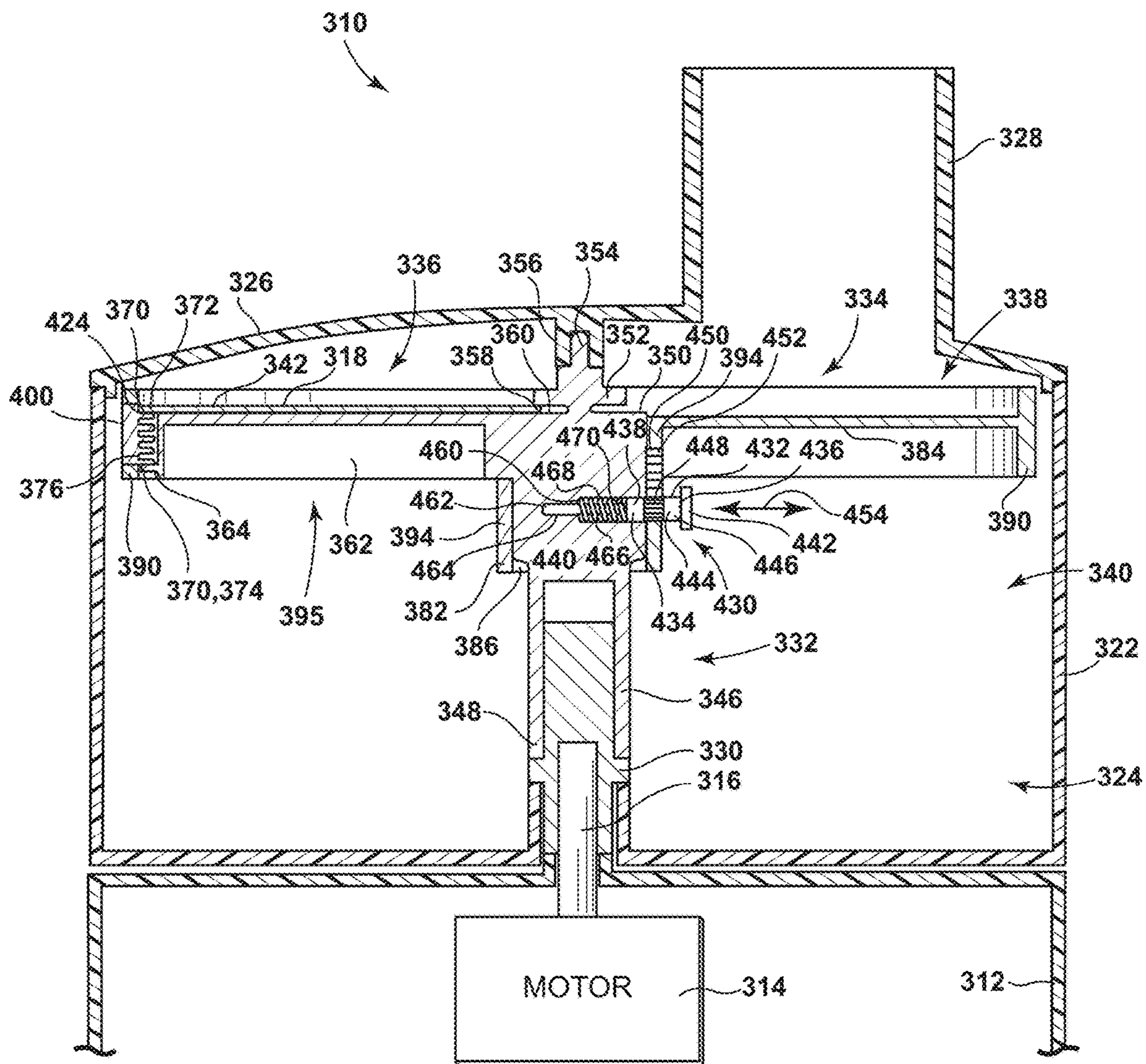


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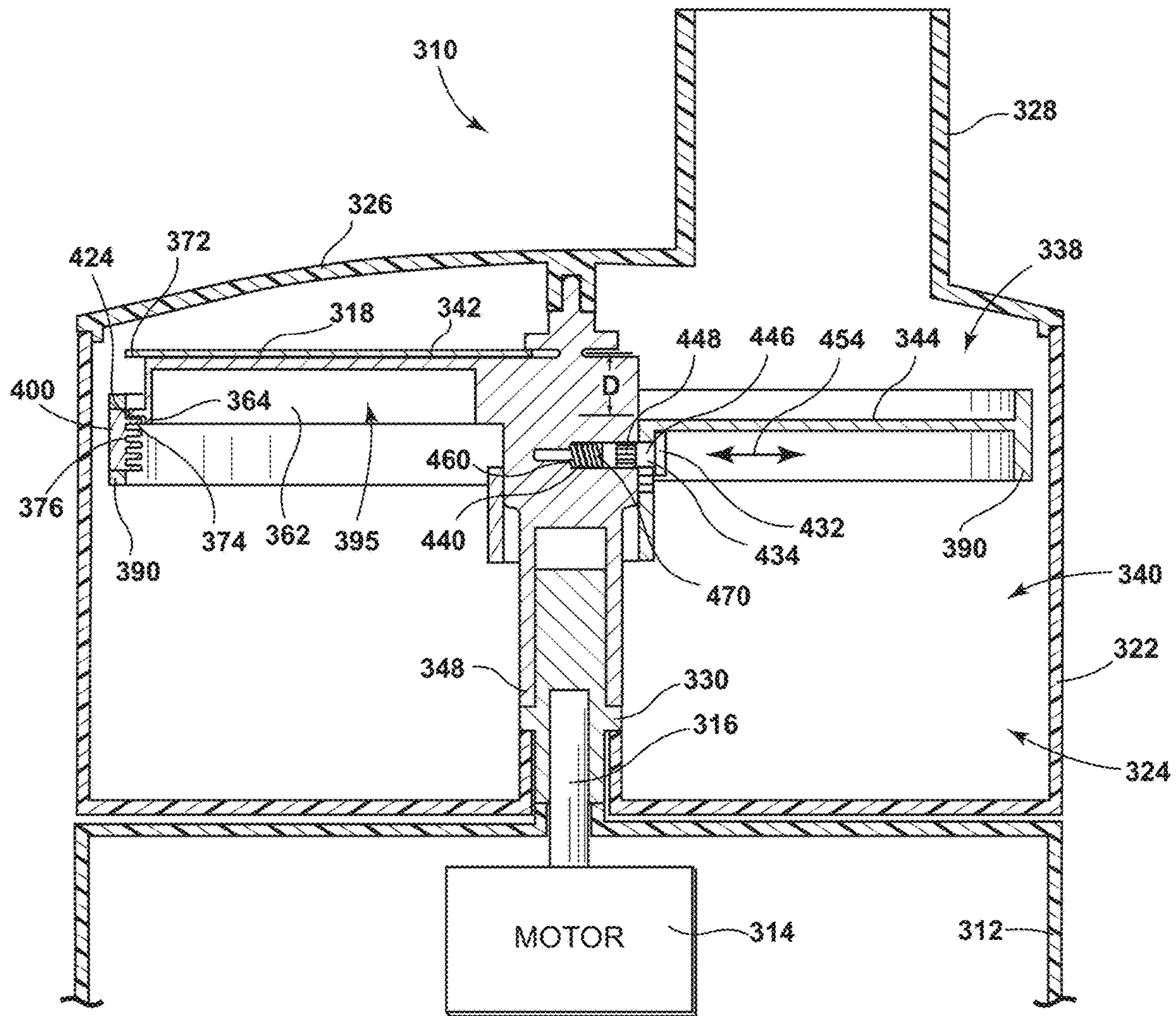


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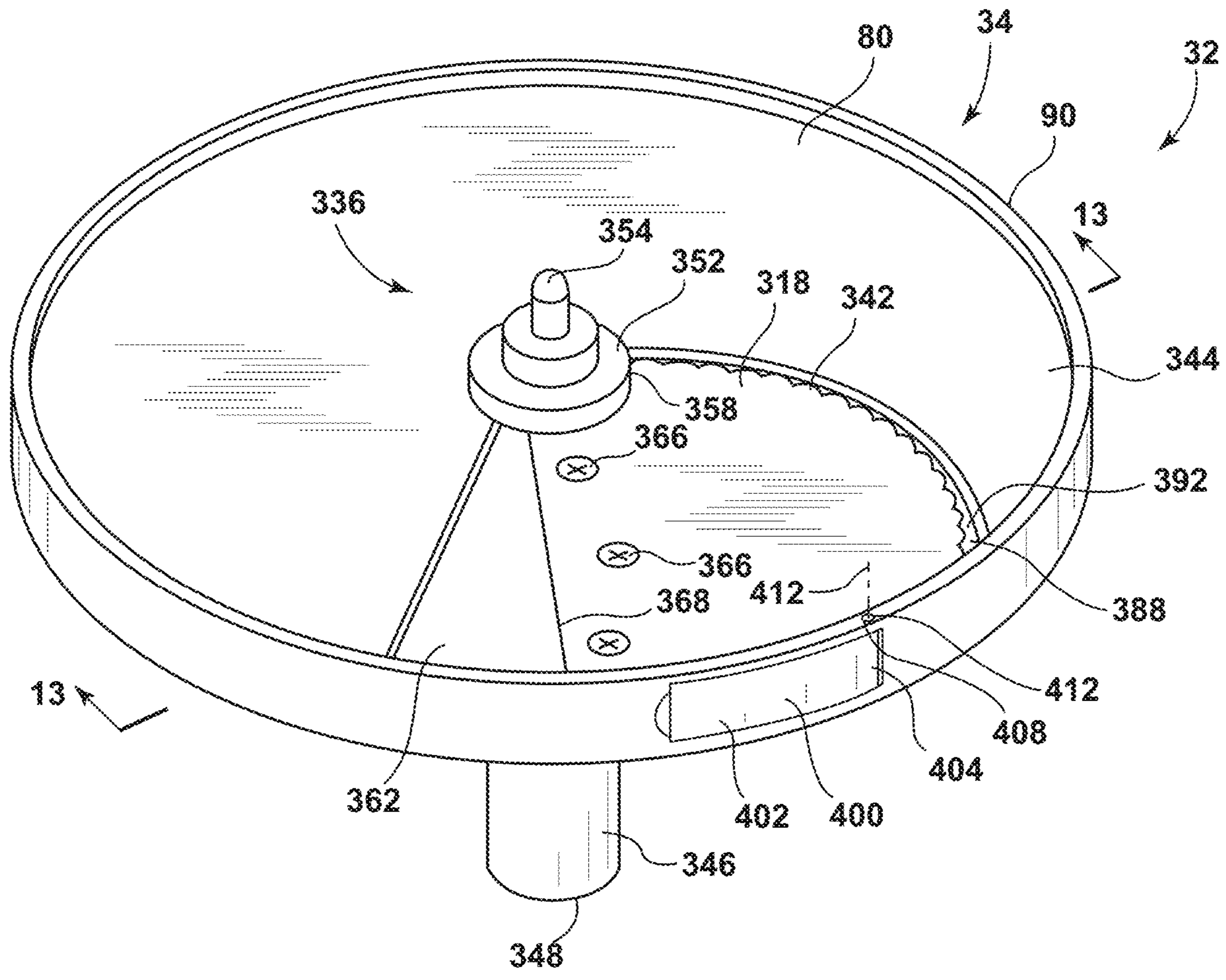


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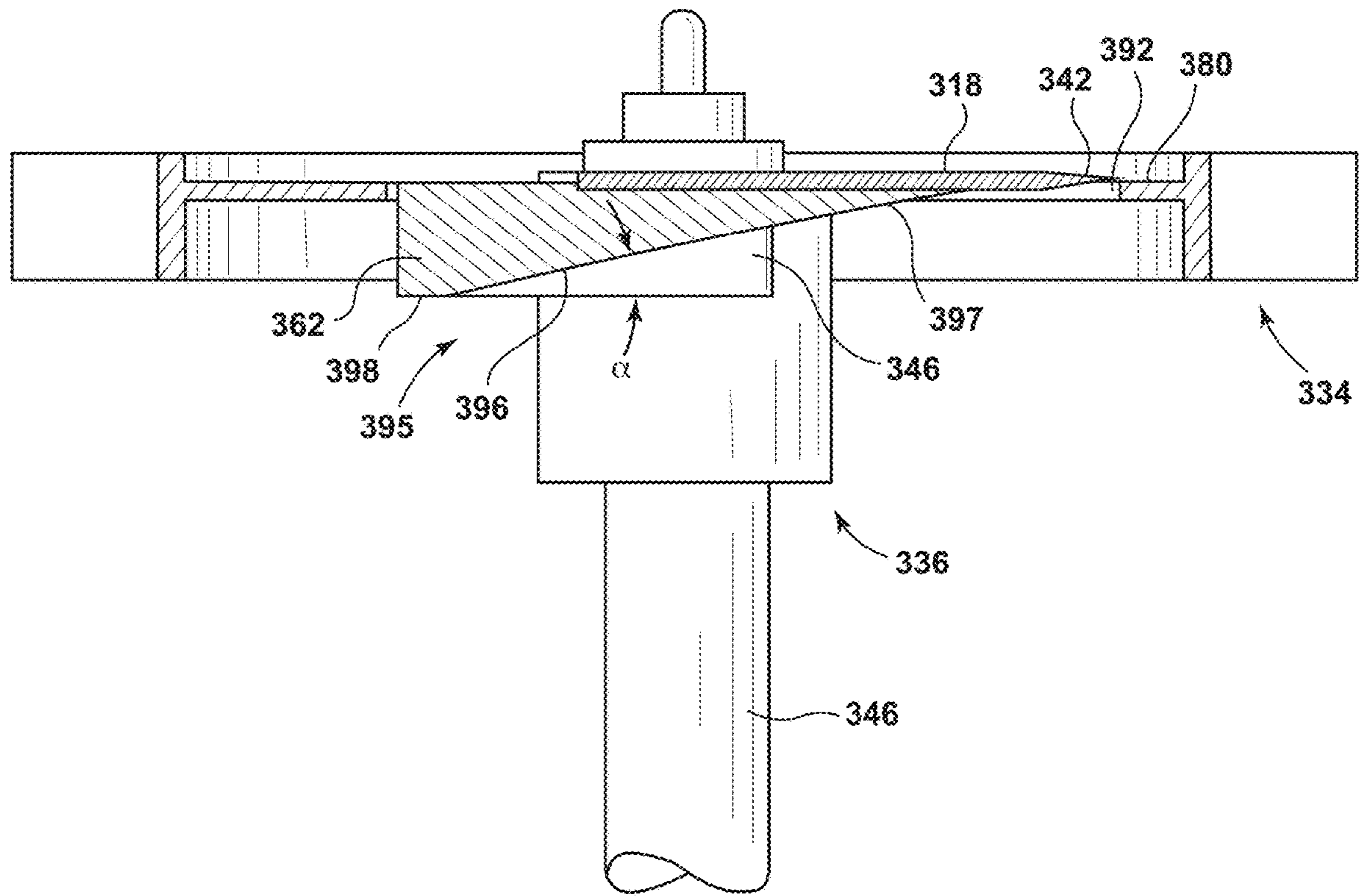


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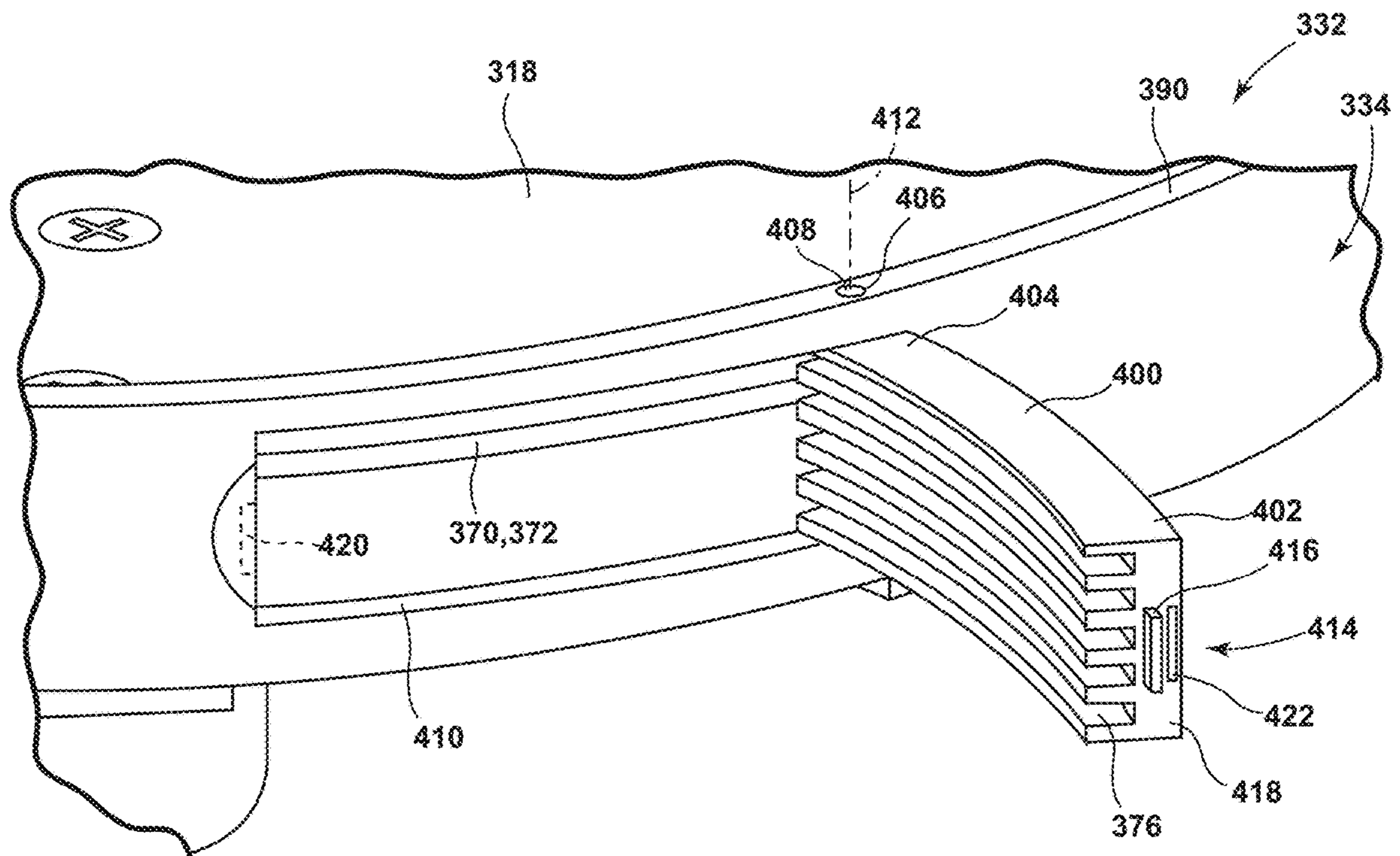


FIG. 14



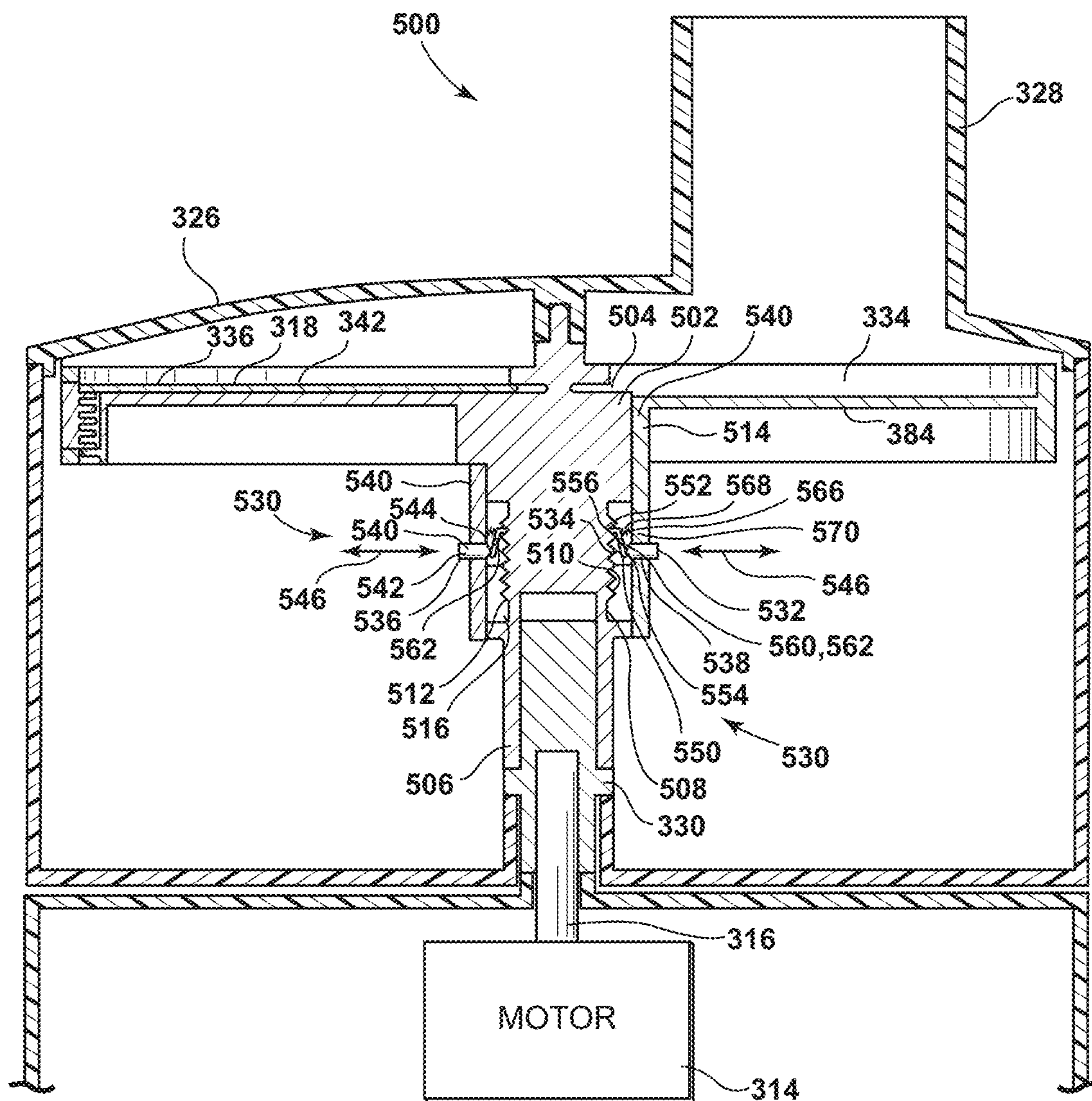


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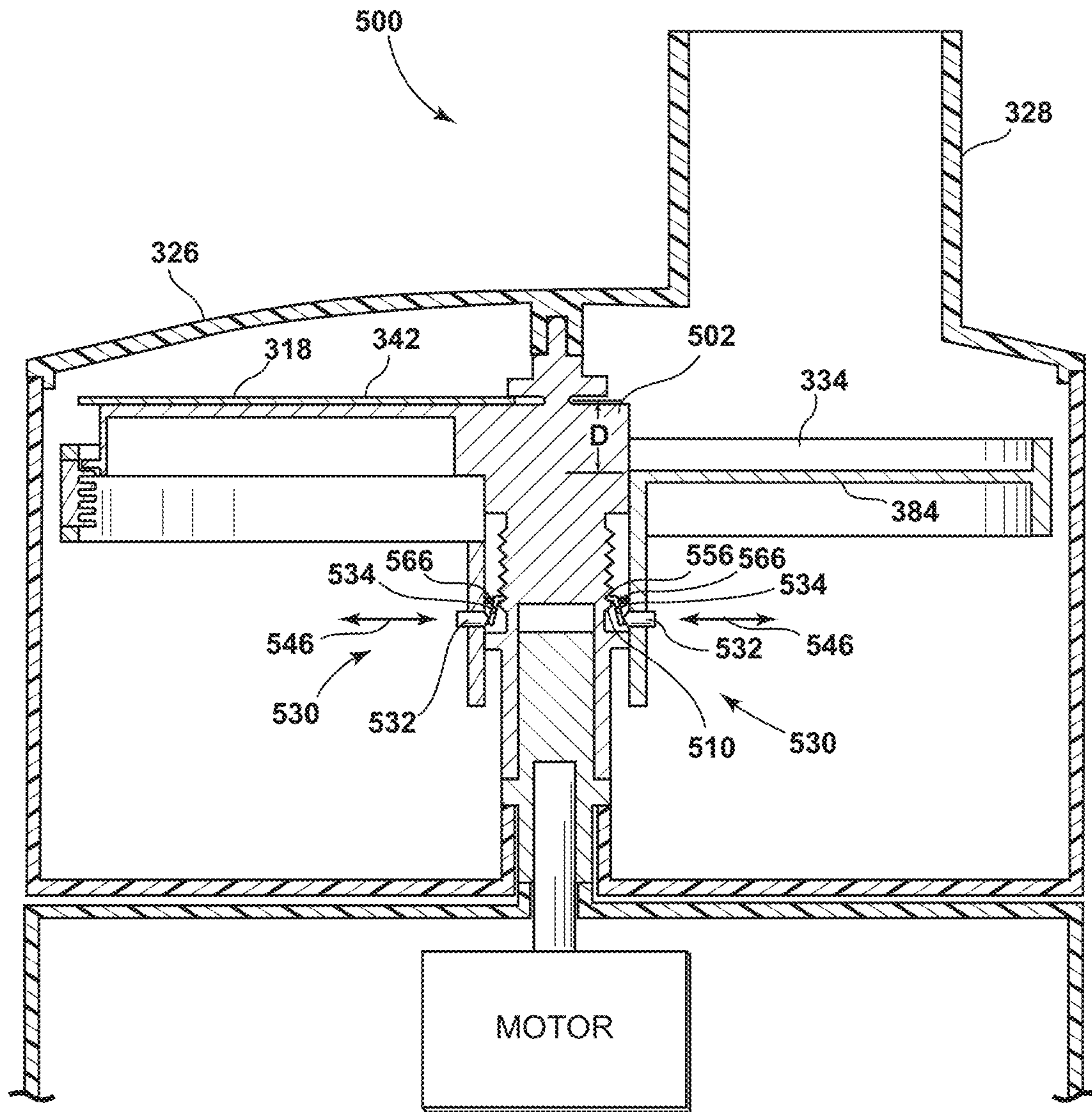


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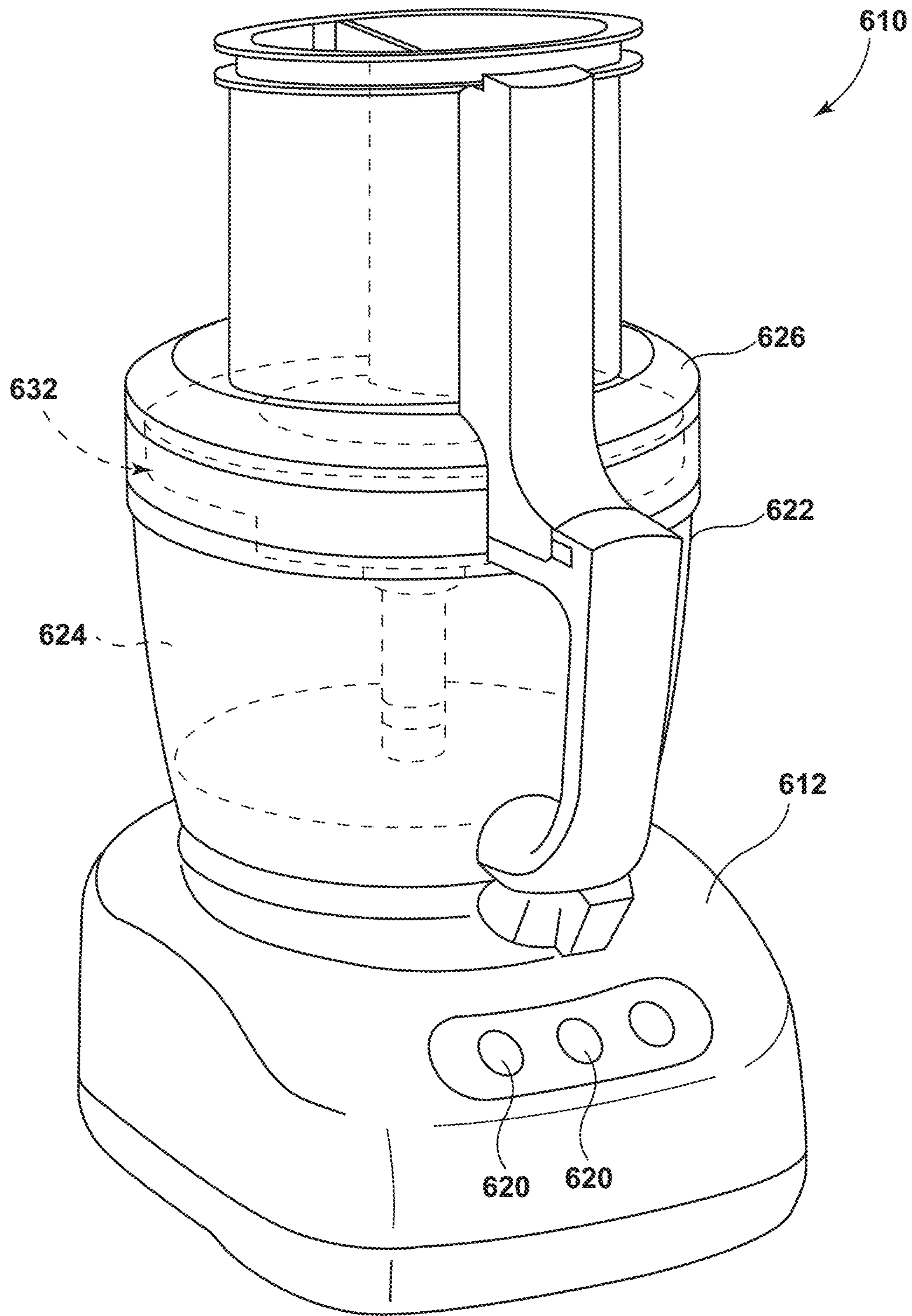


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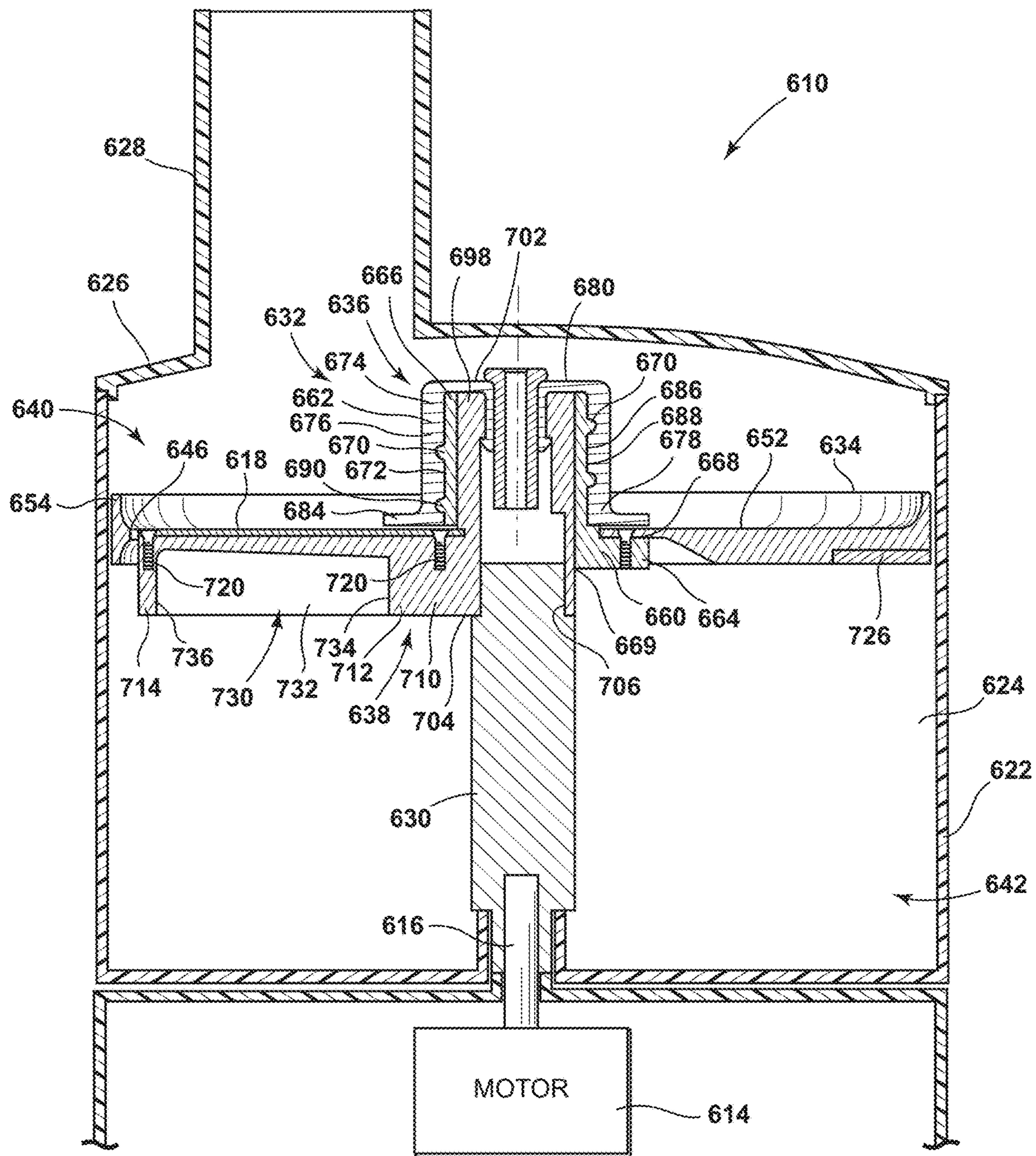


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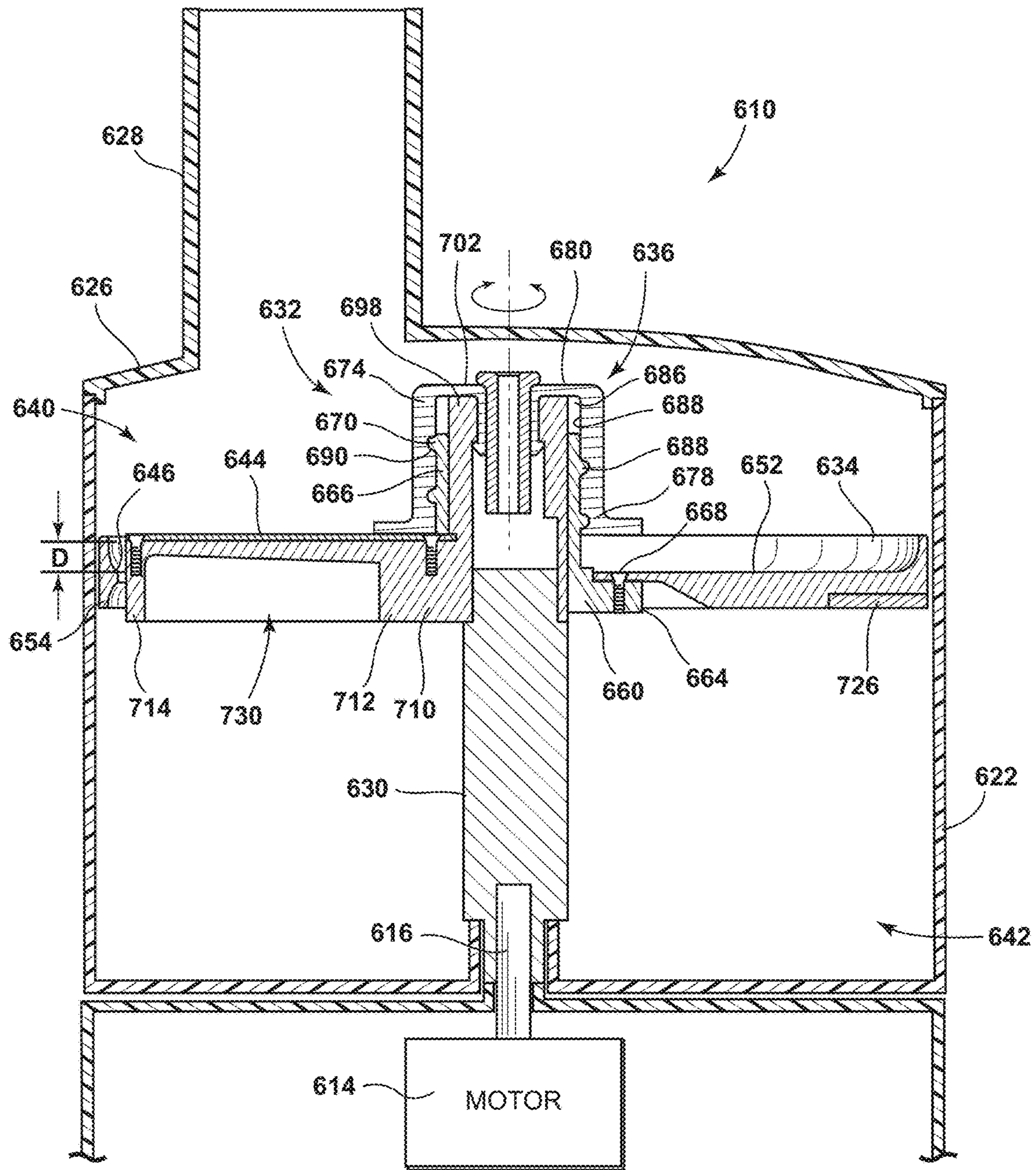


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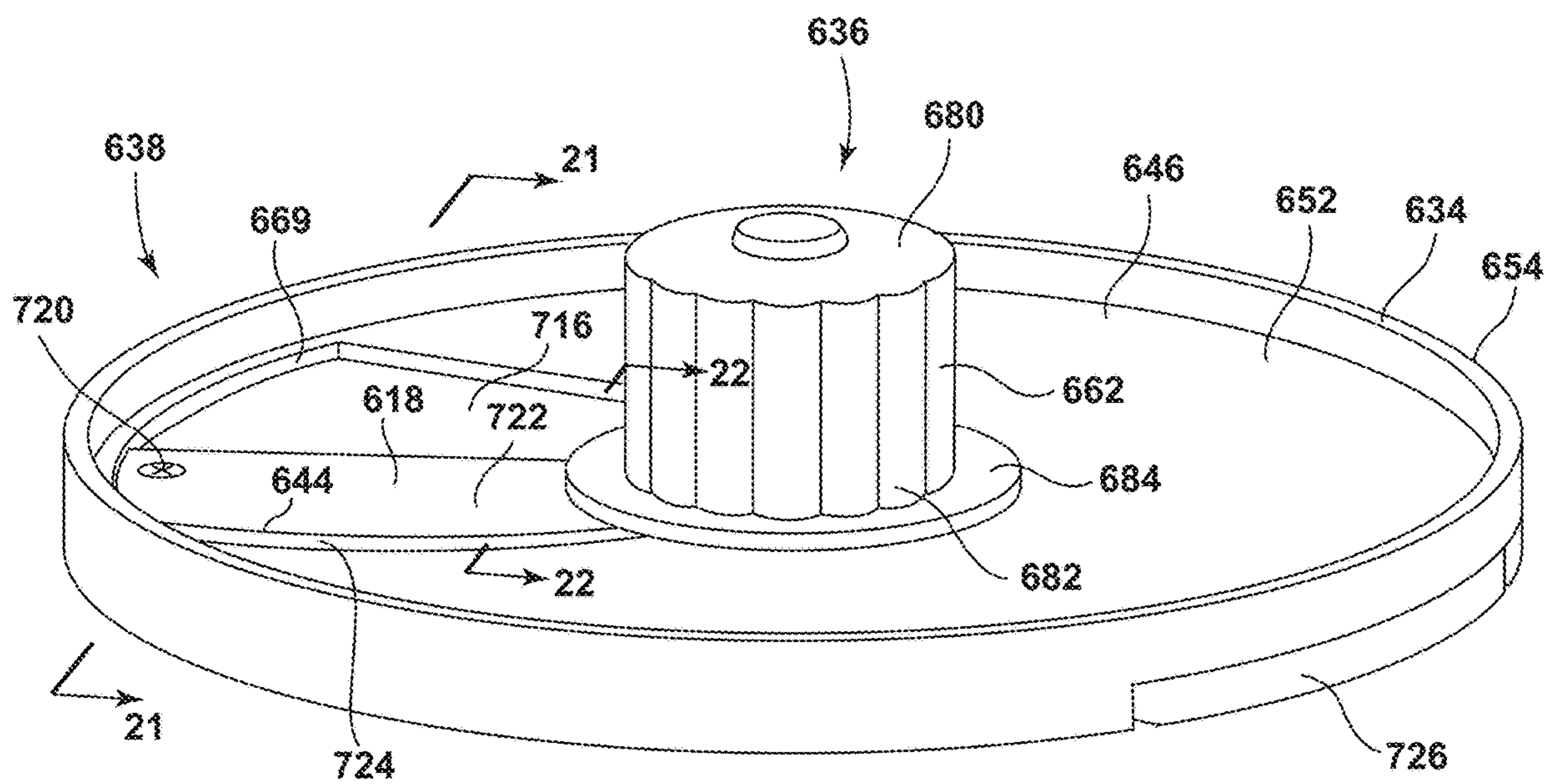


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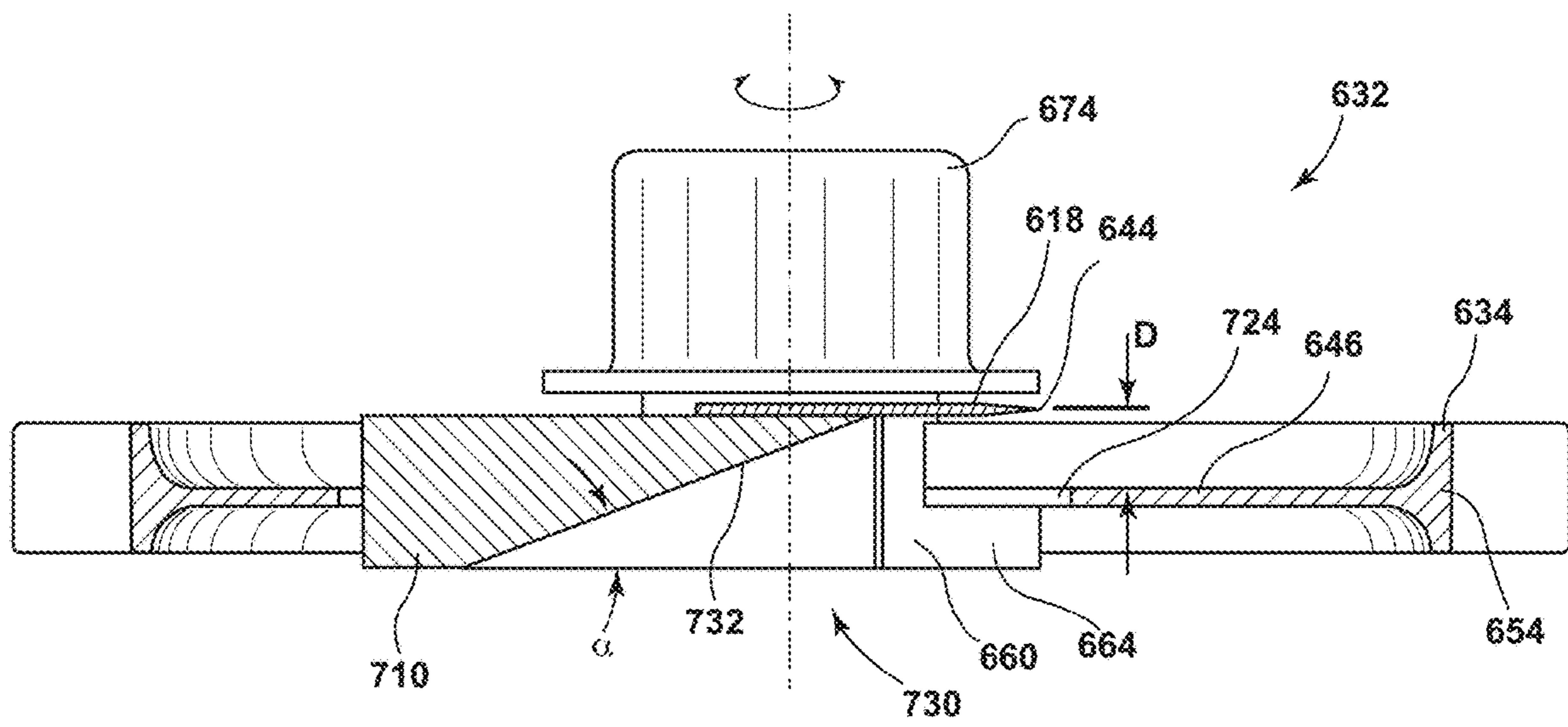


FIG. 21

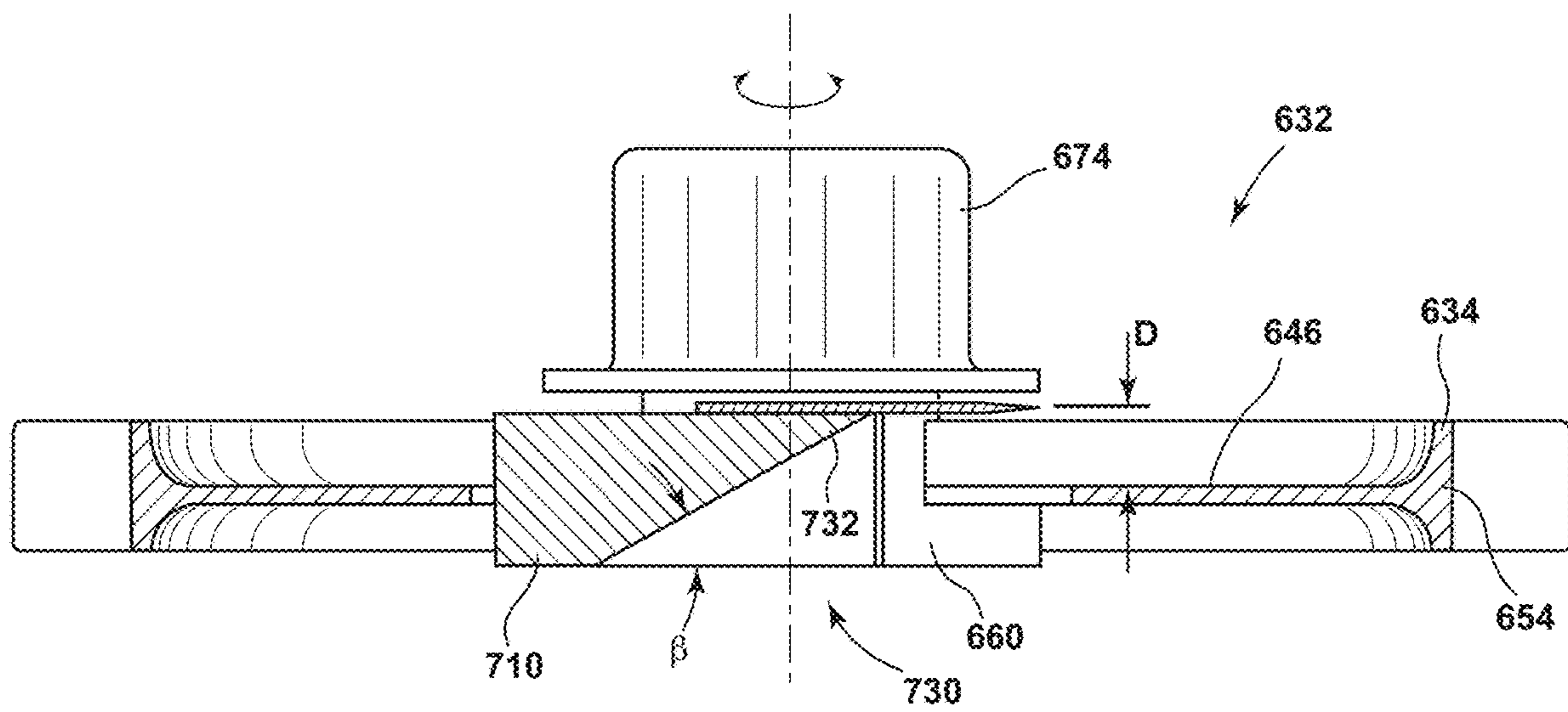


FIG. 22



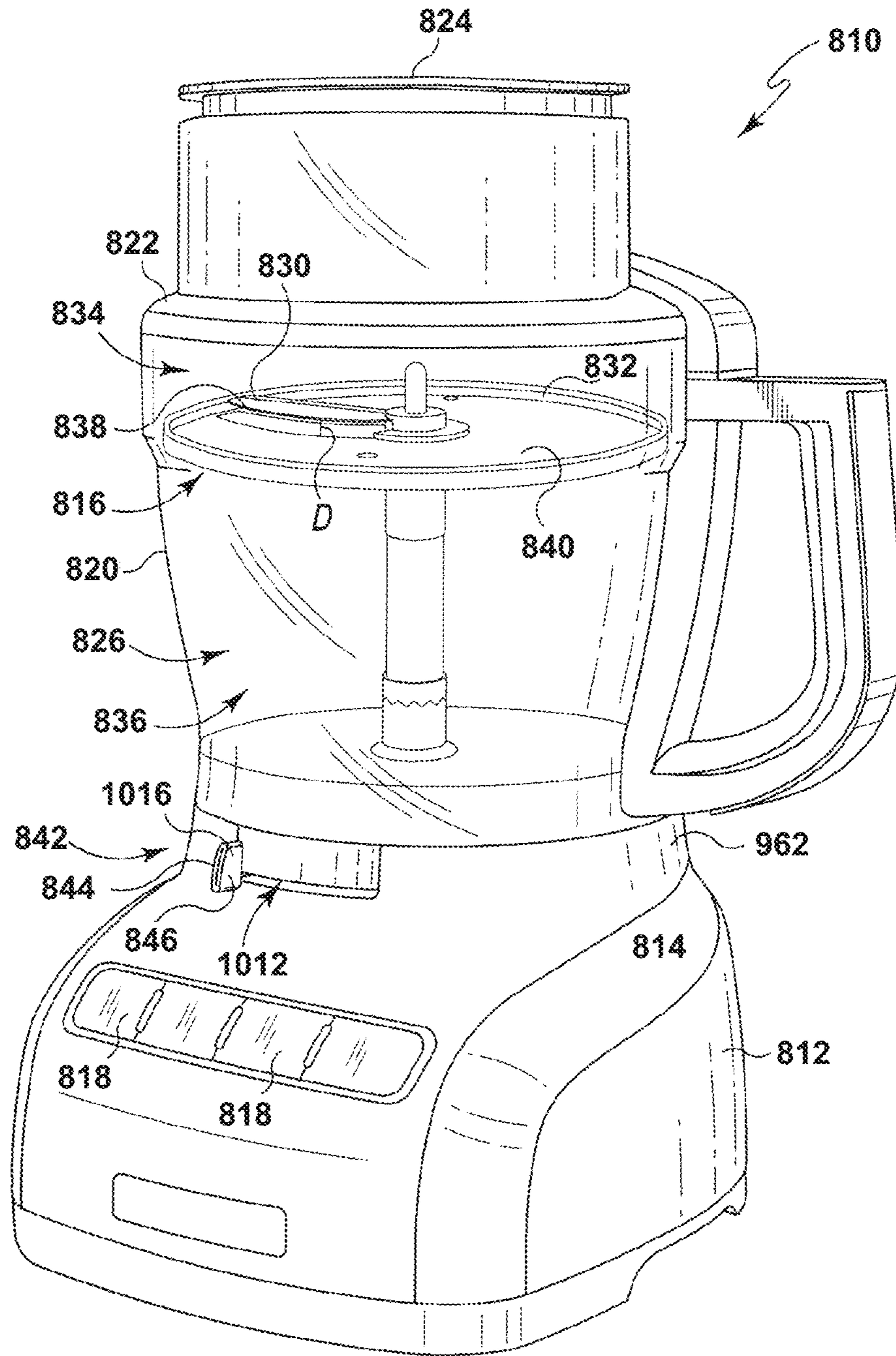


FIG. 23

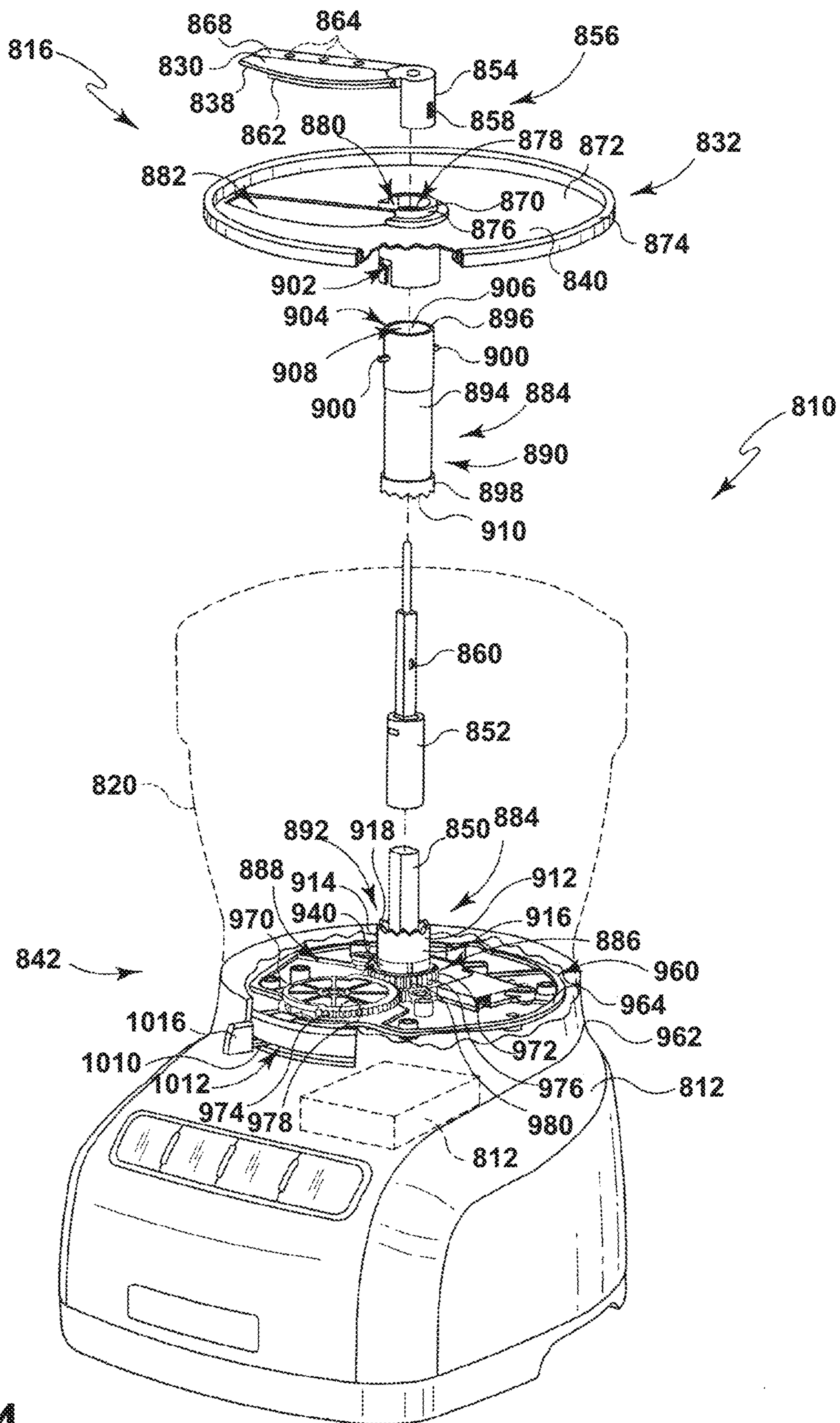


FIG. 24

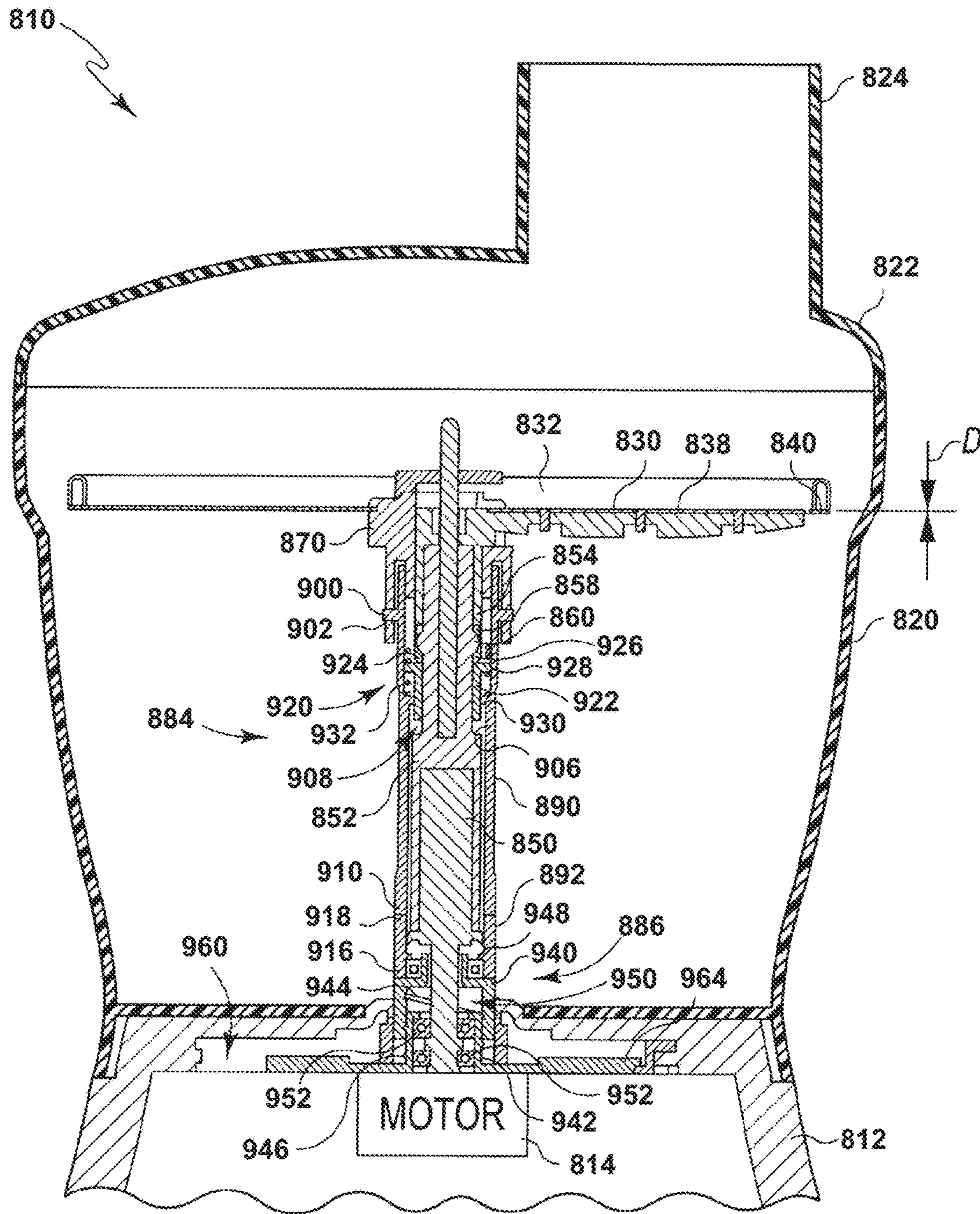


FIG. 25

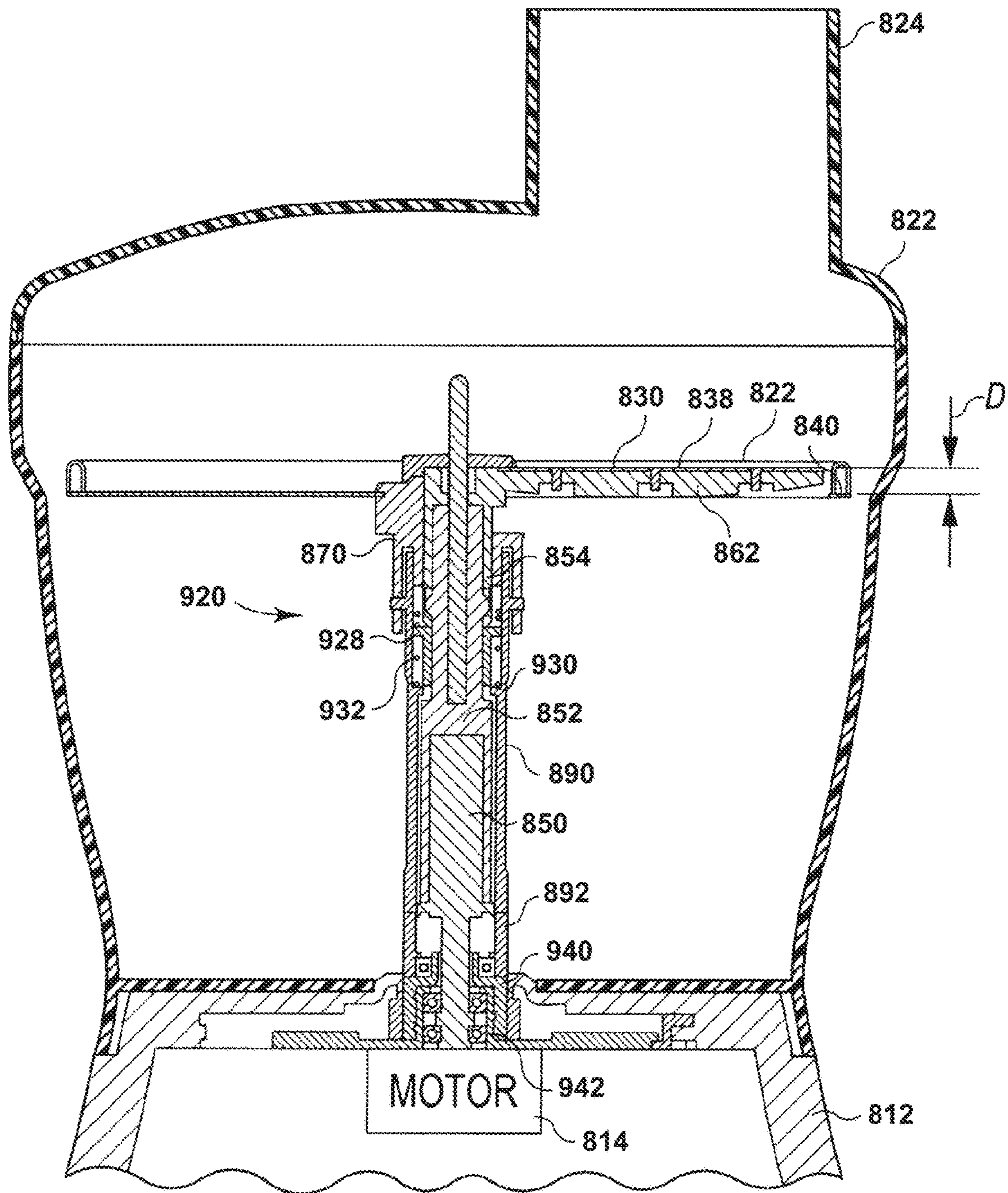


FIG. 26

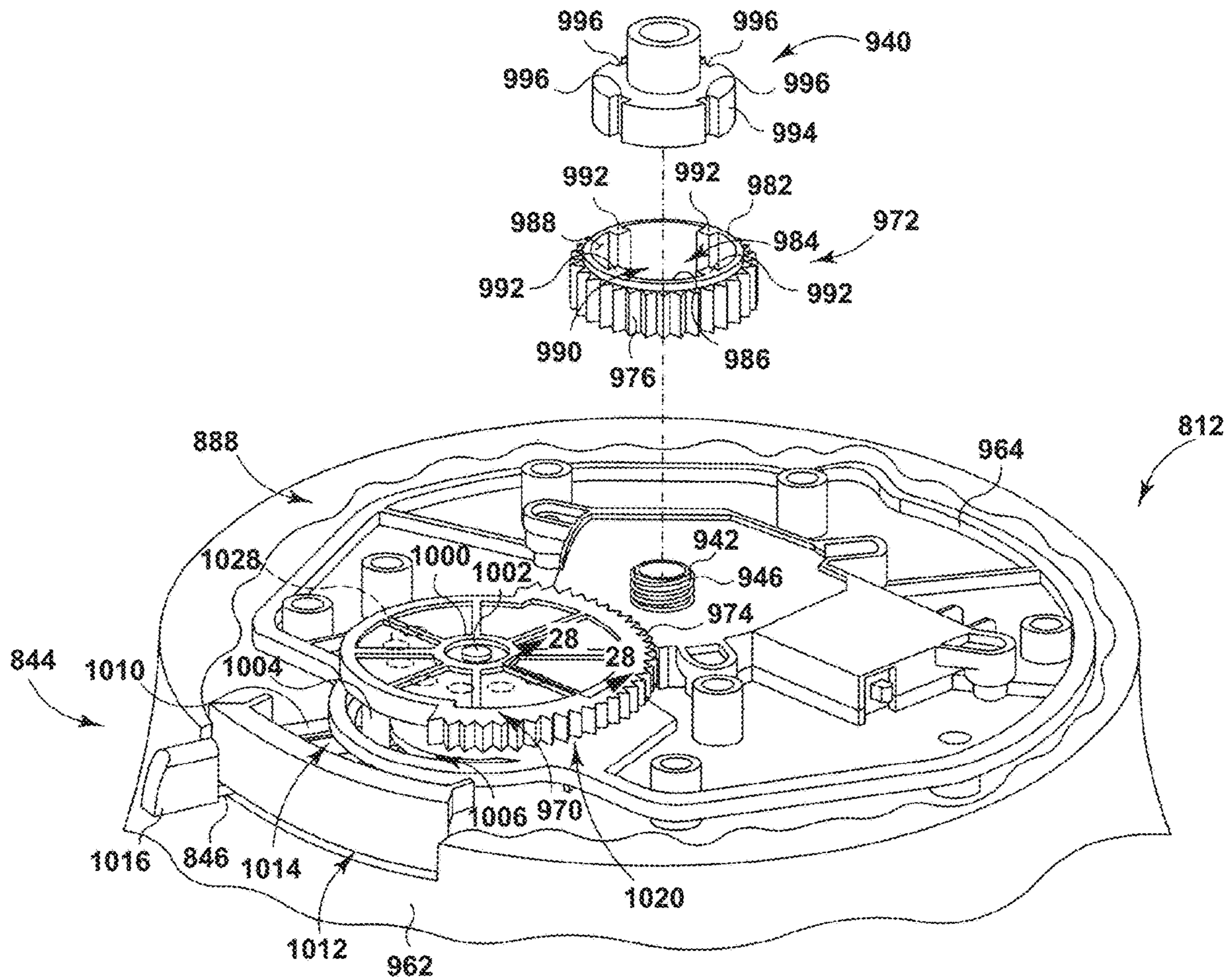


FIG. 27

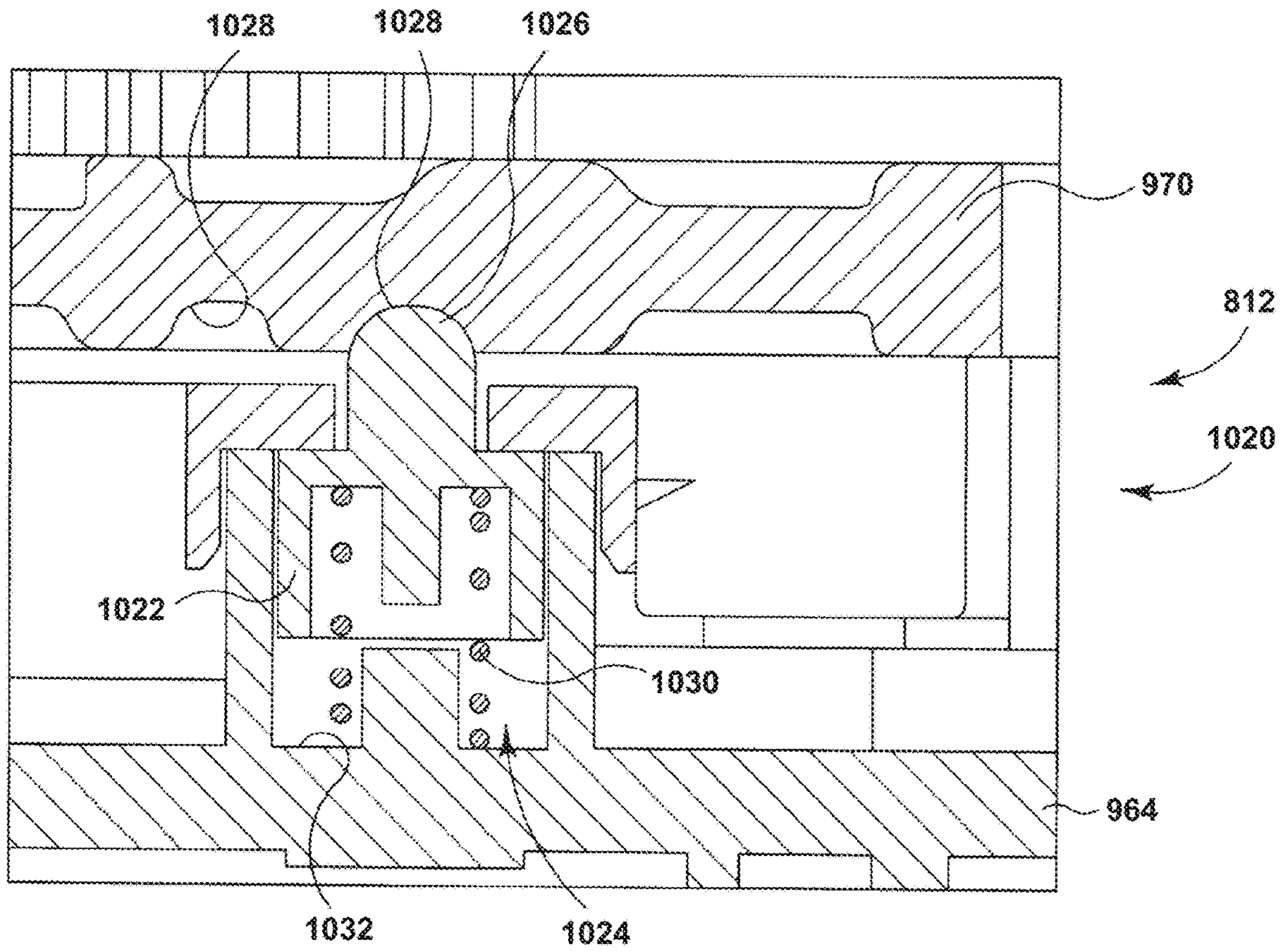


FIG. 28

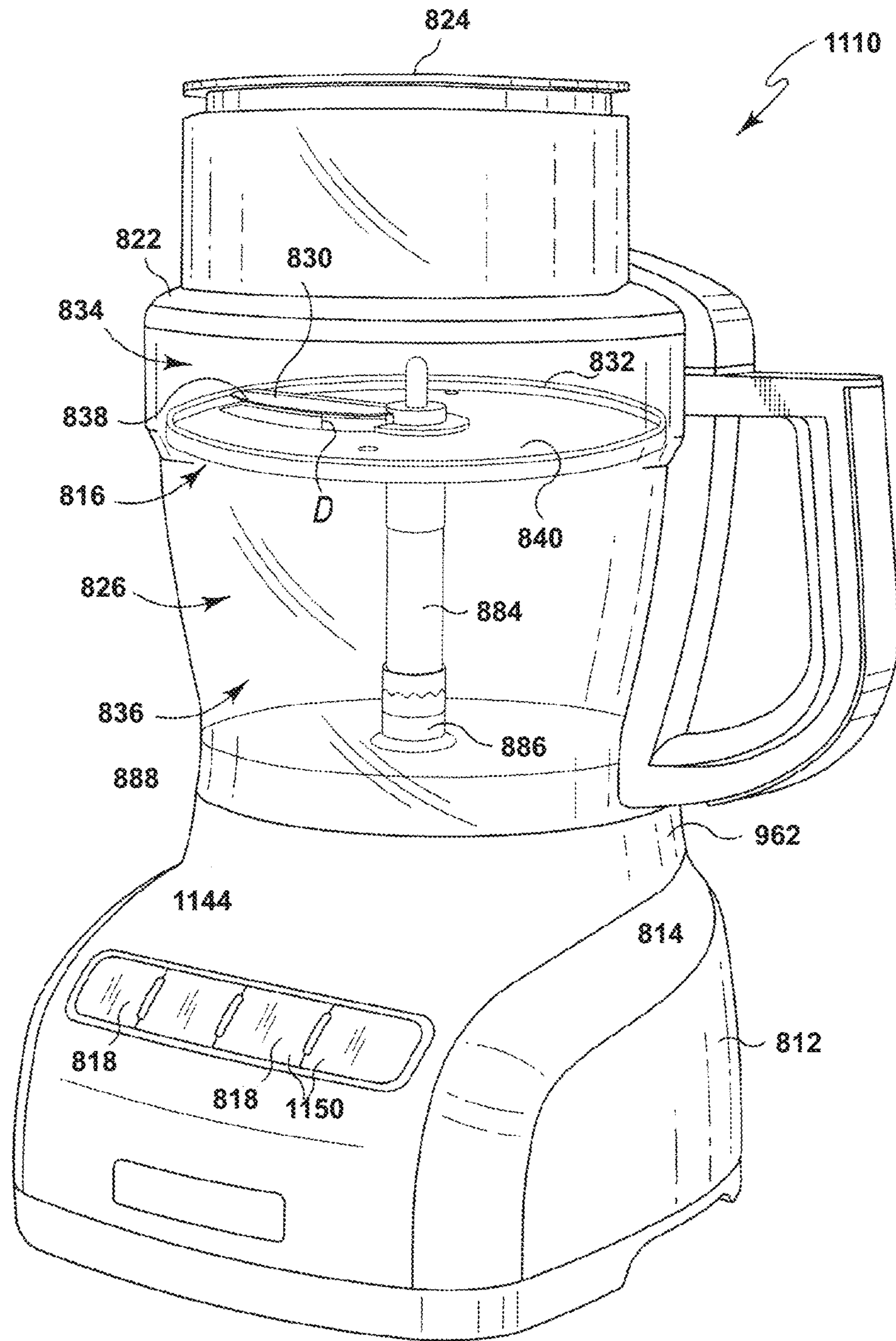


FIG. 29

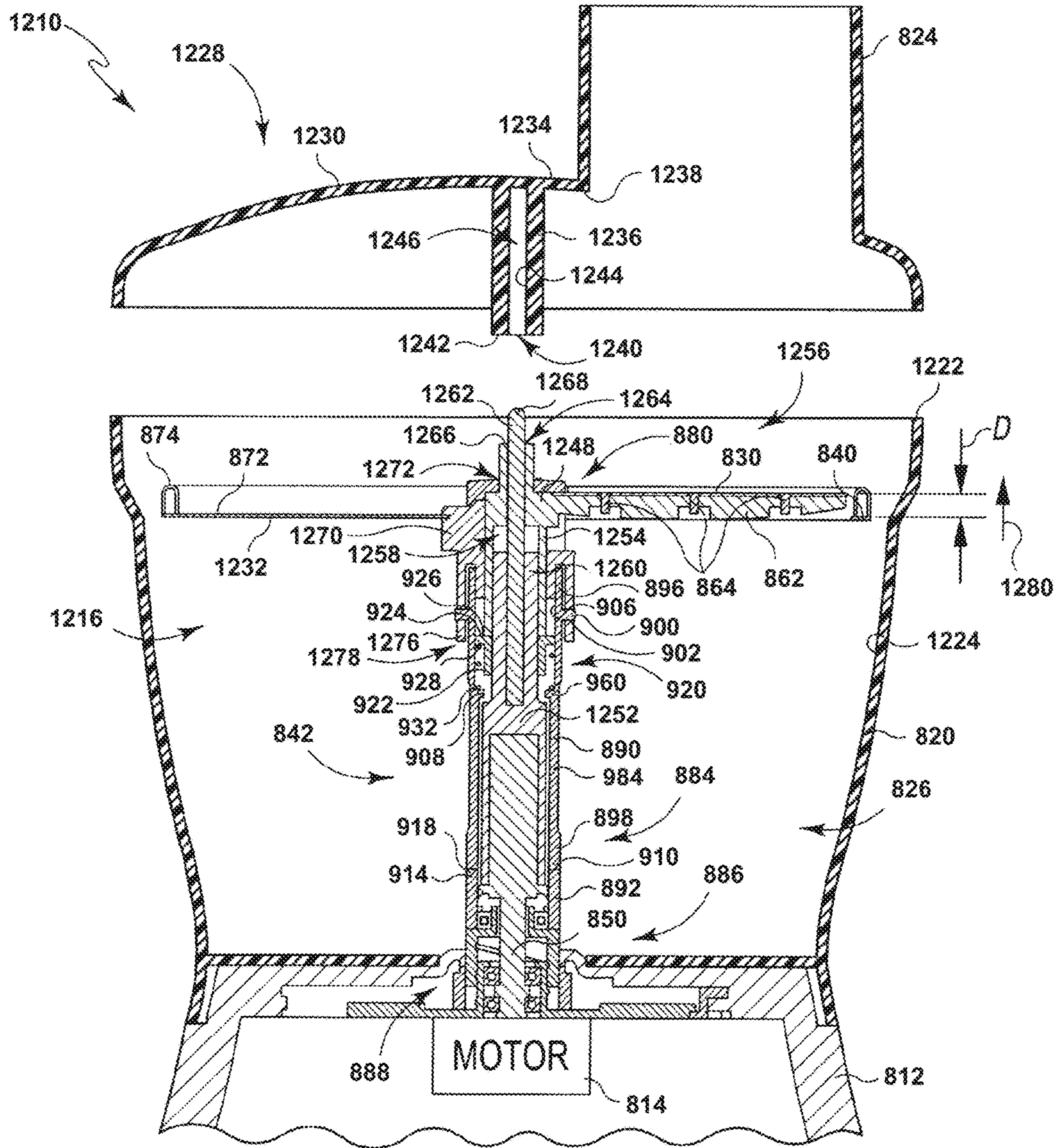


FIG. 30



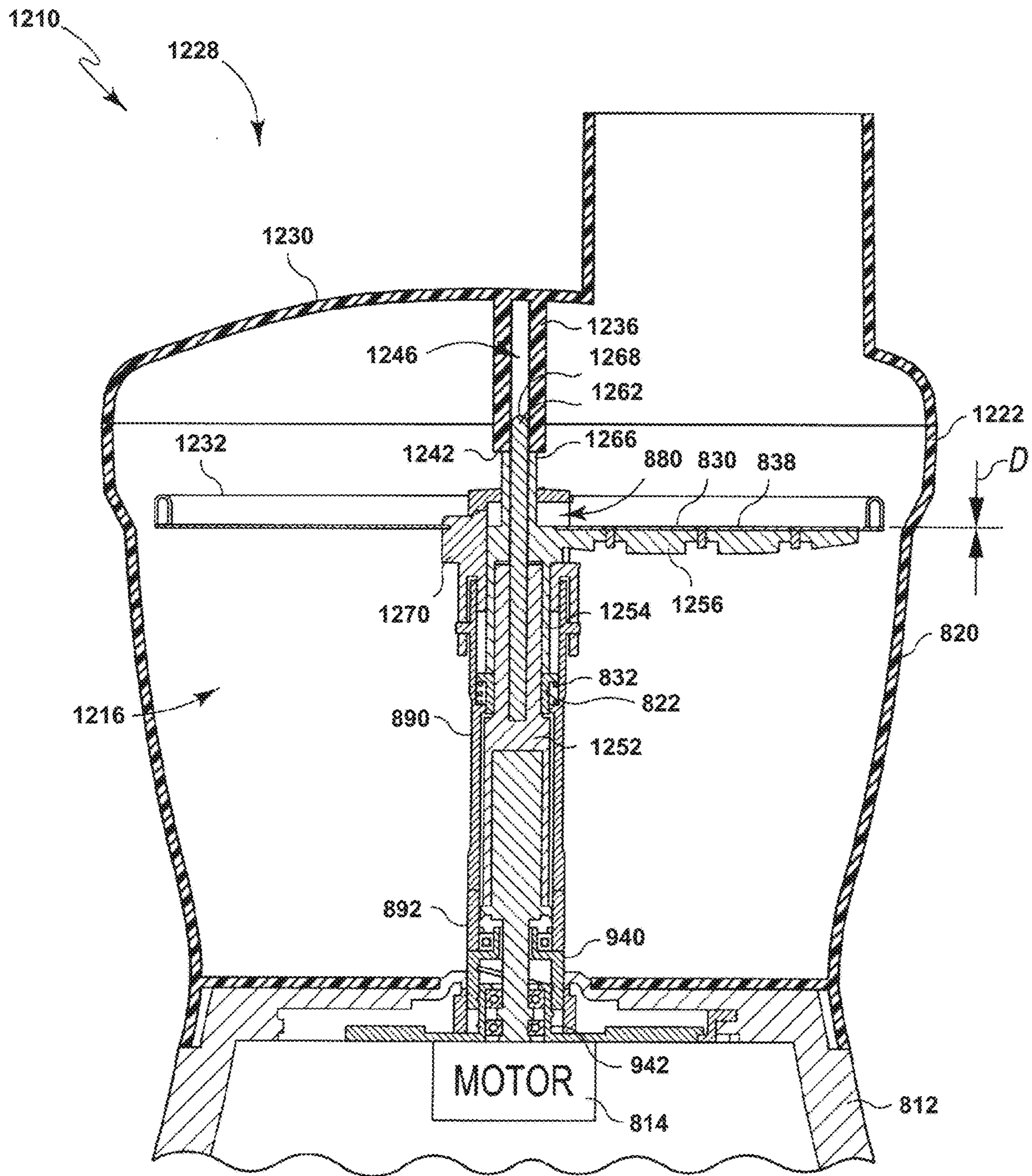


FIG. 31

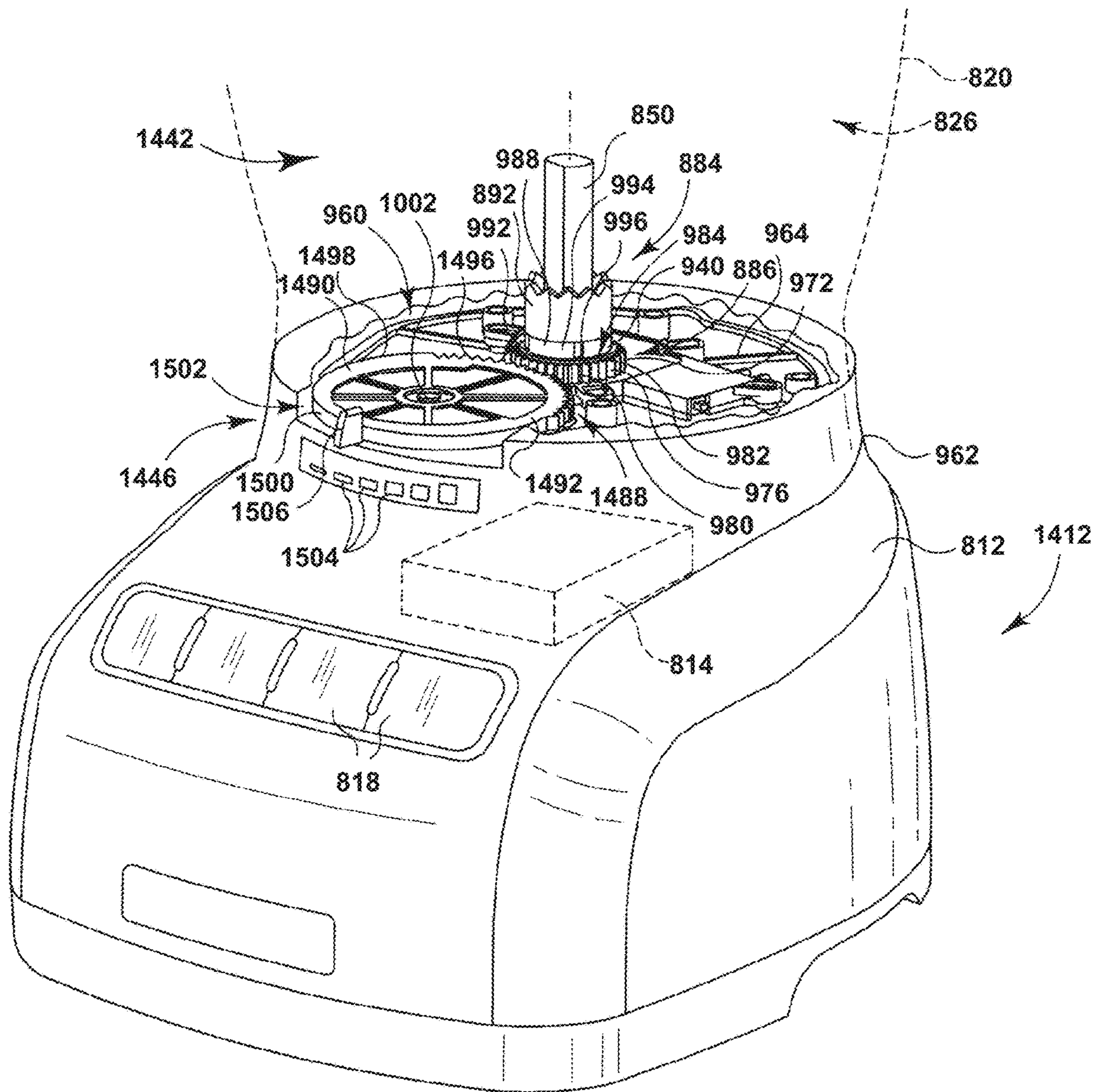


FIG. 32

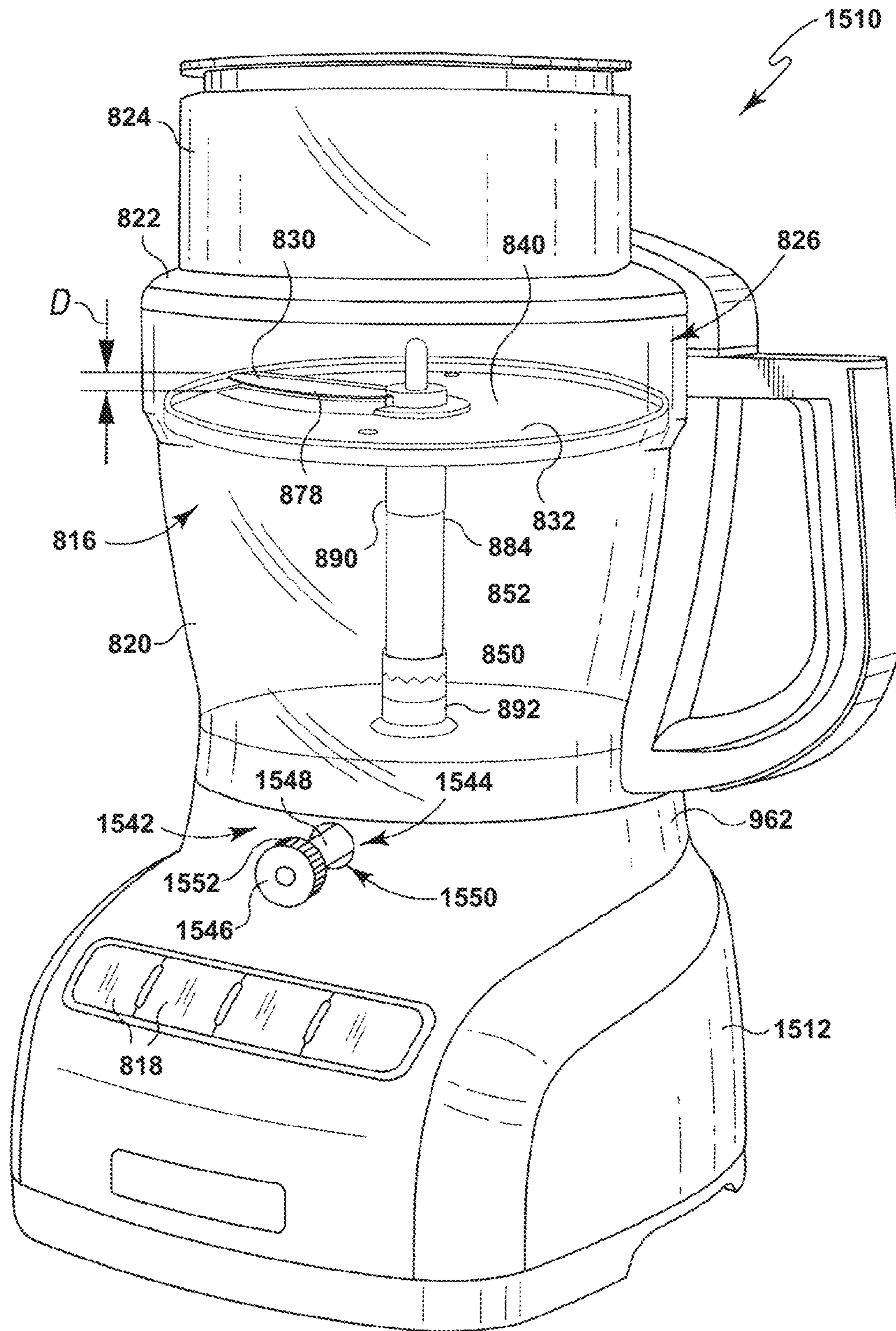


FIG. 33

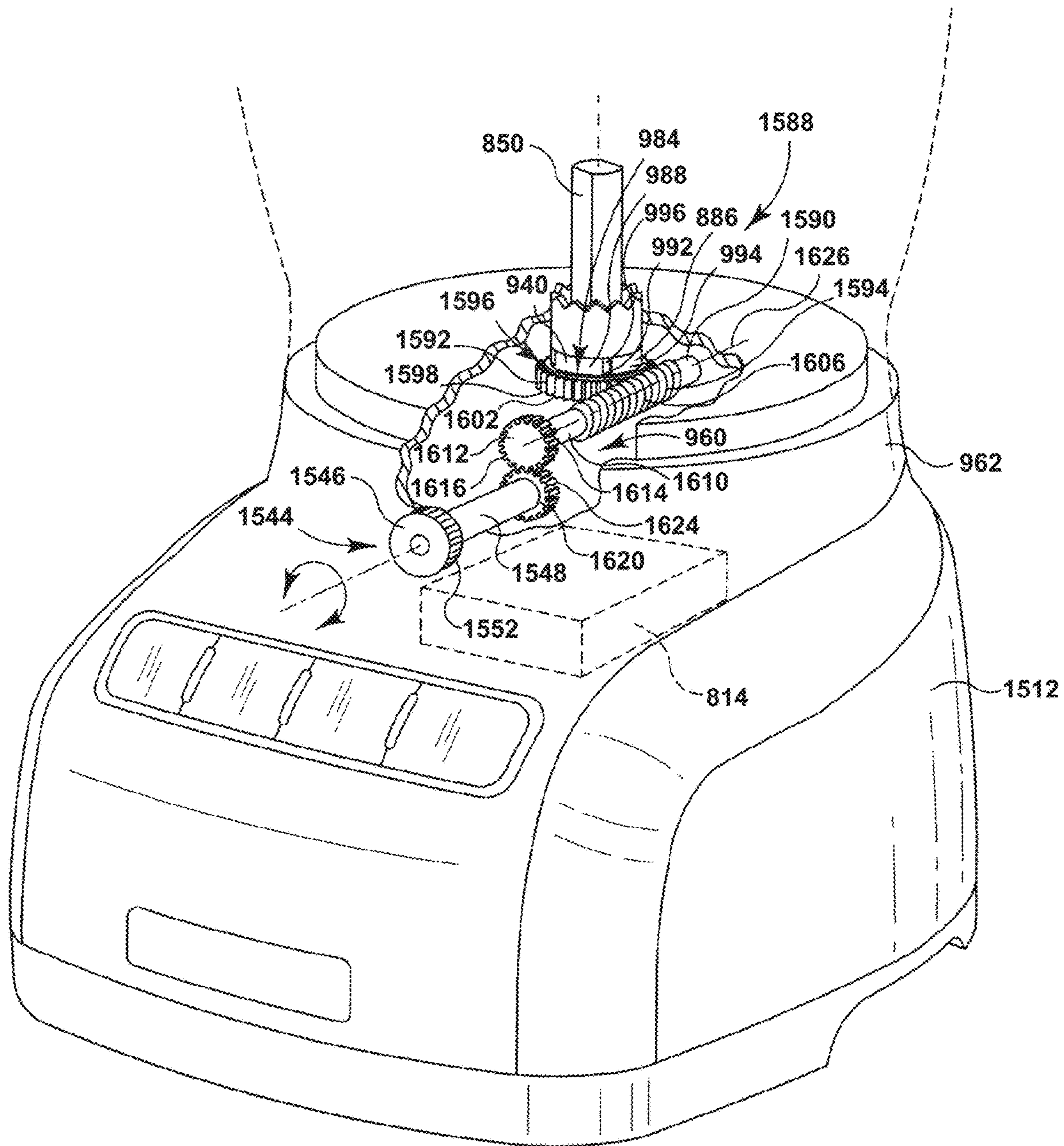


FIG. 34

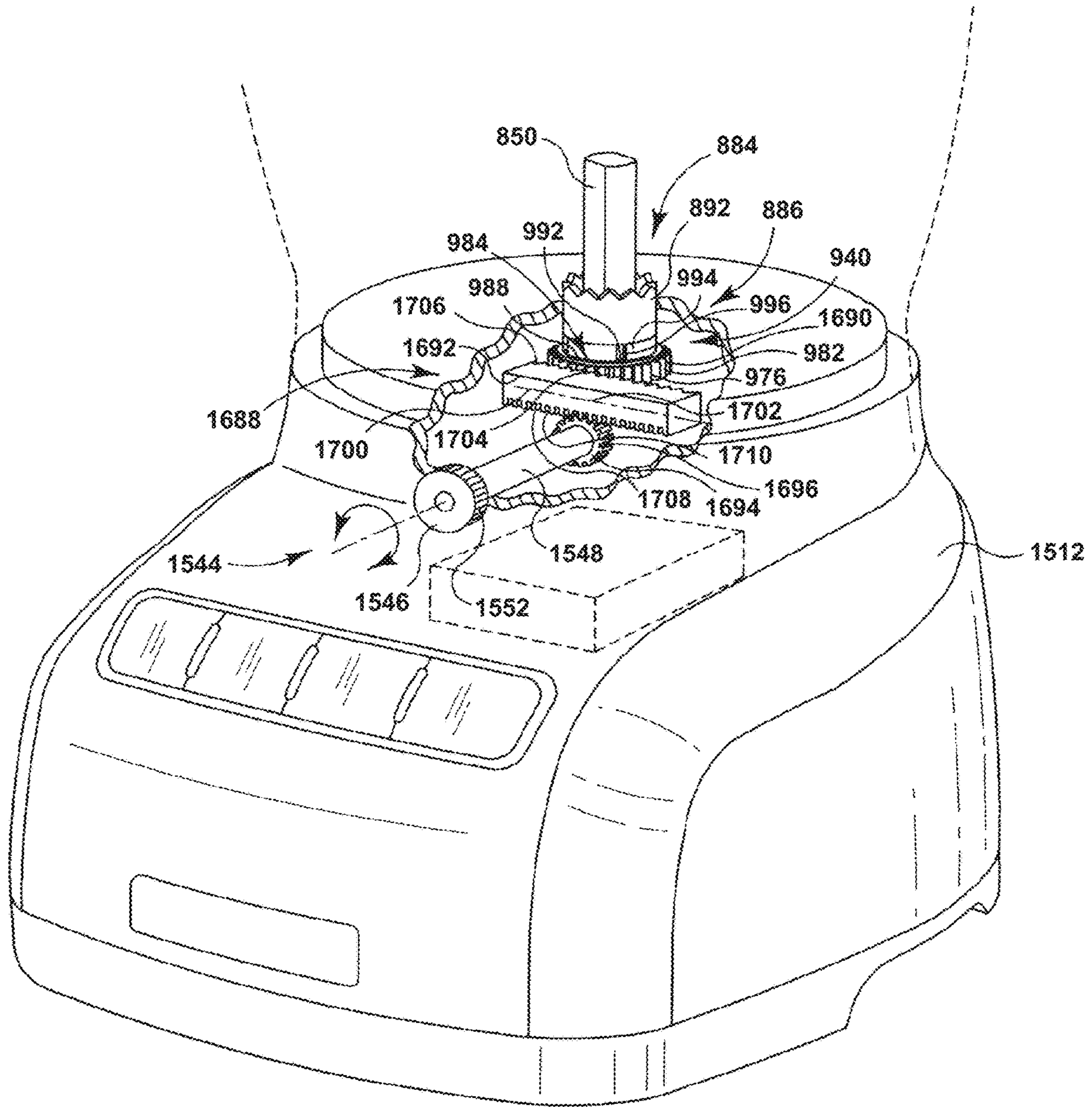


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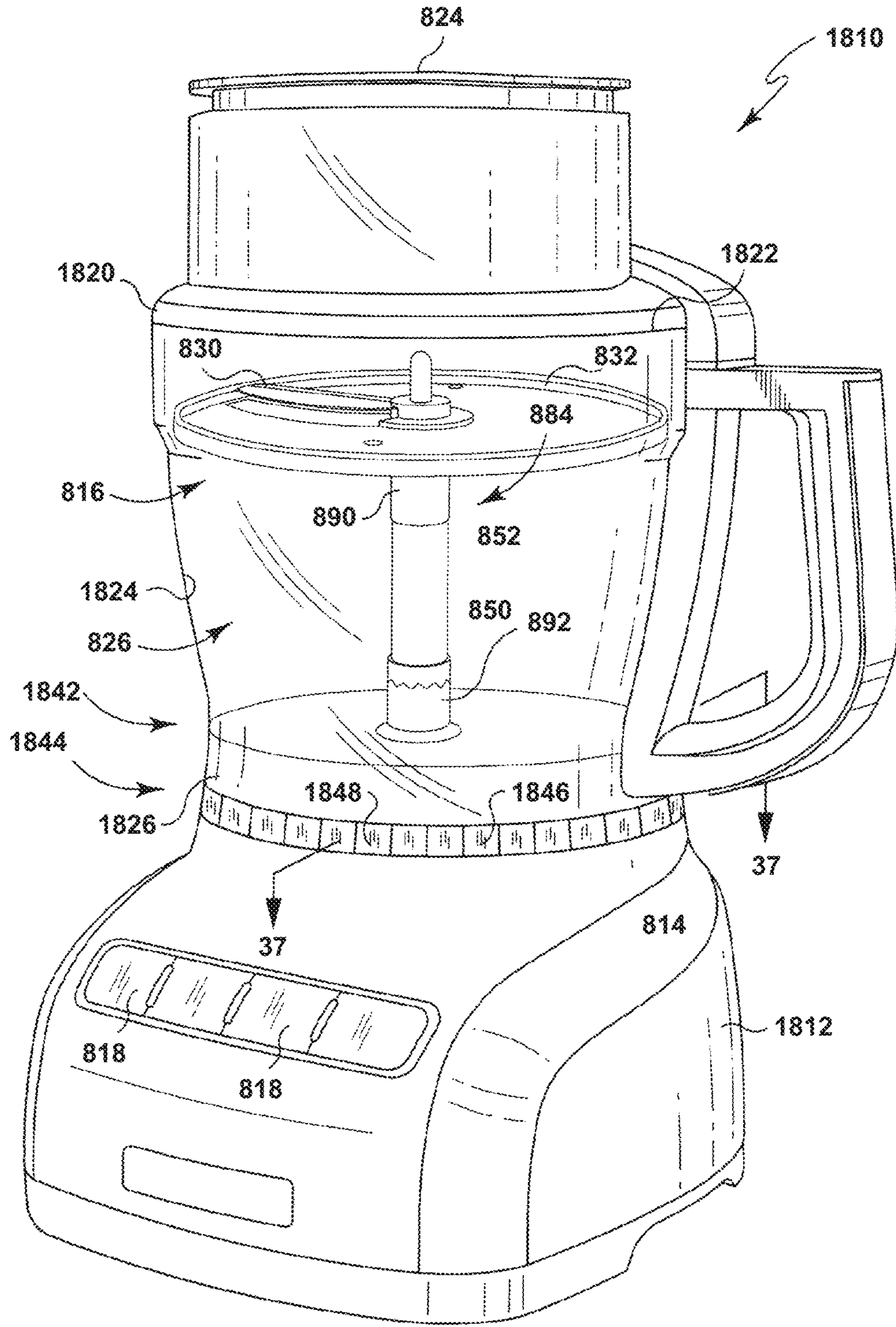


FIG. 36

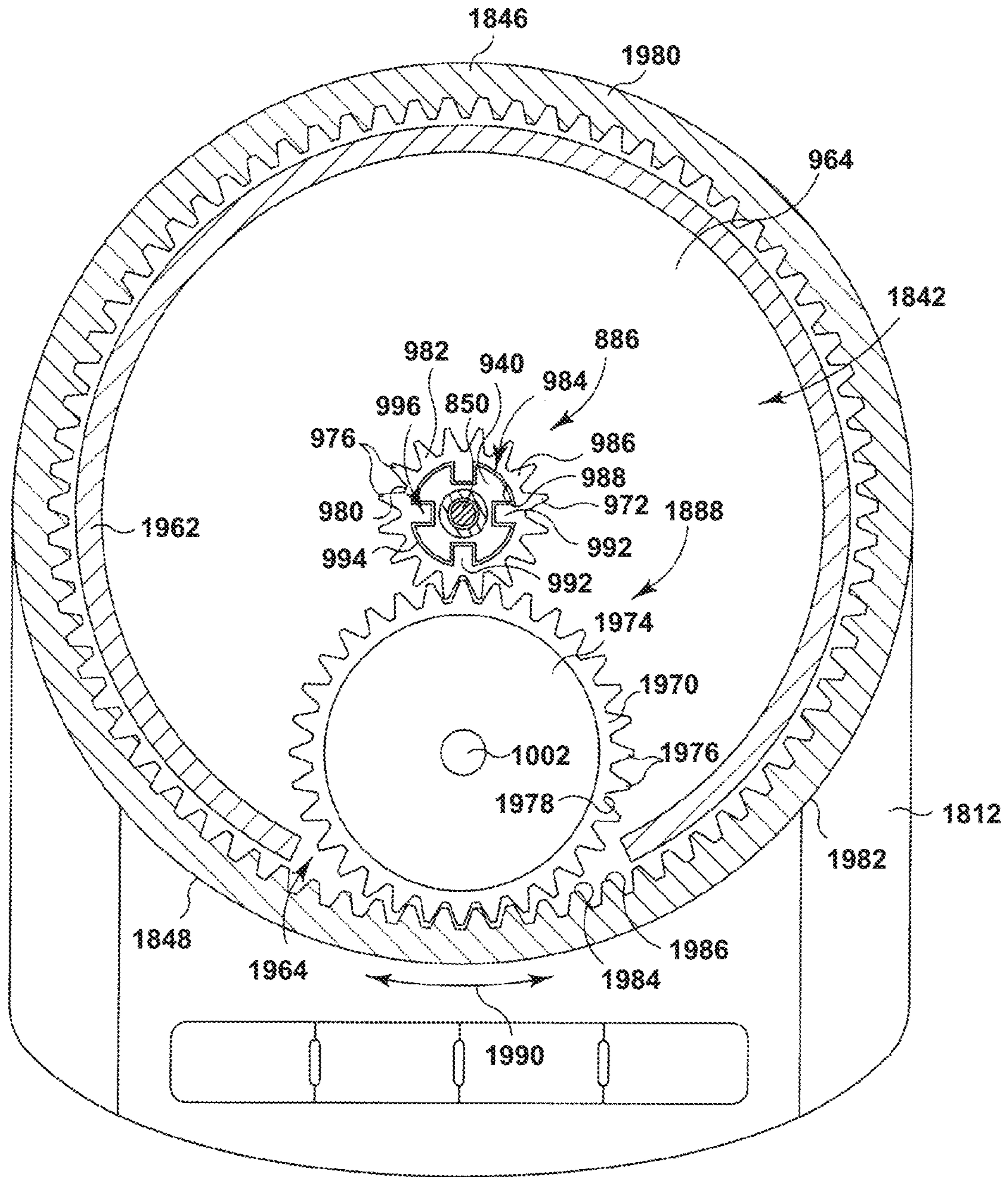


FIG. 37

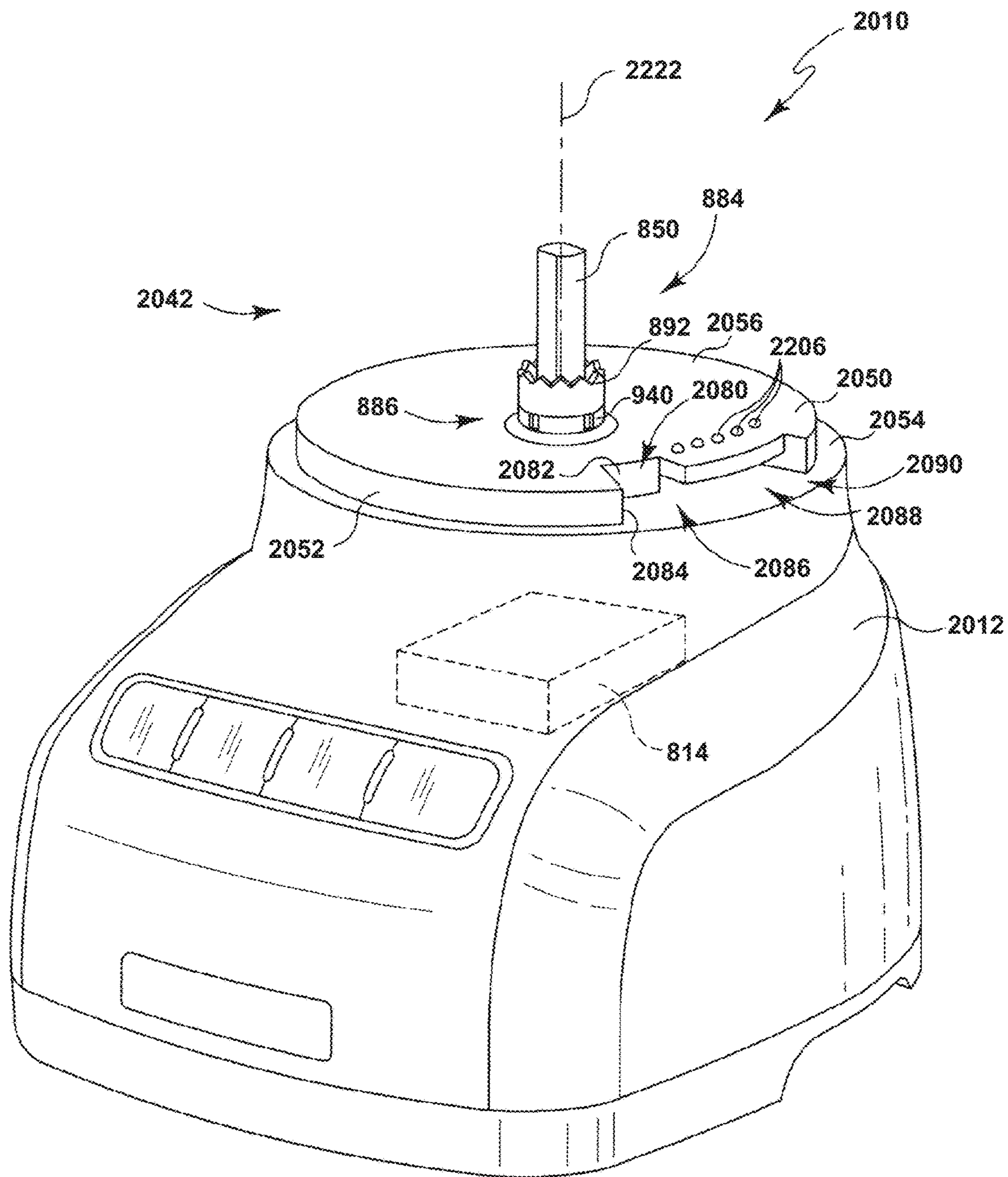


FIG. 38



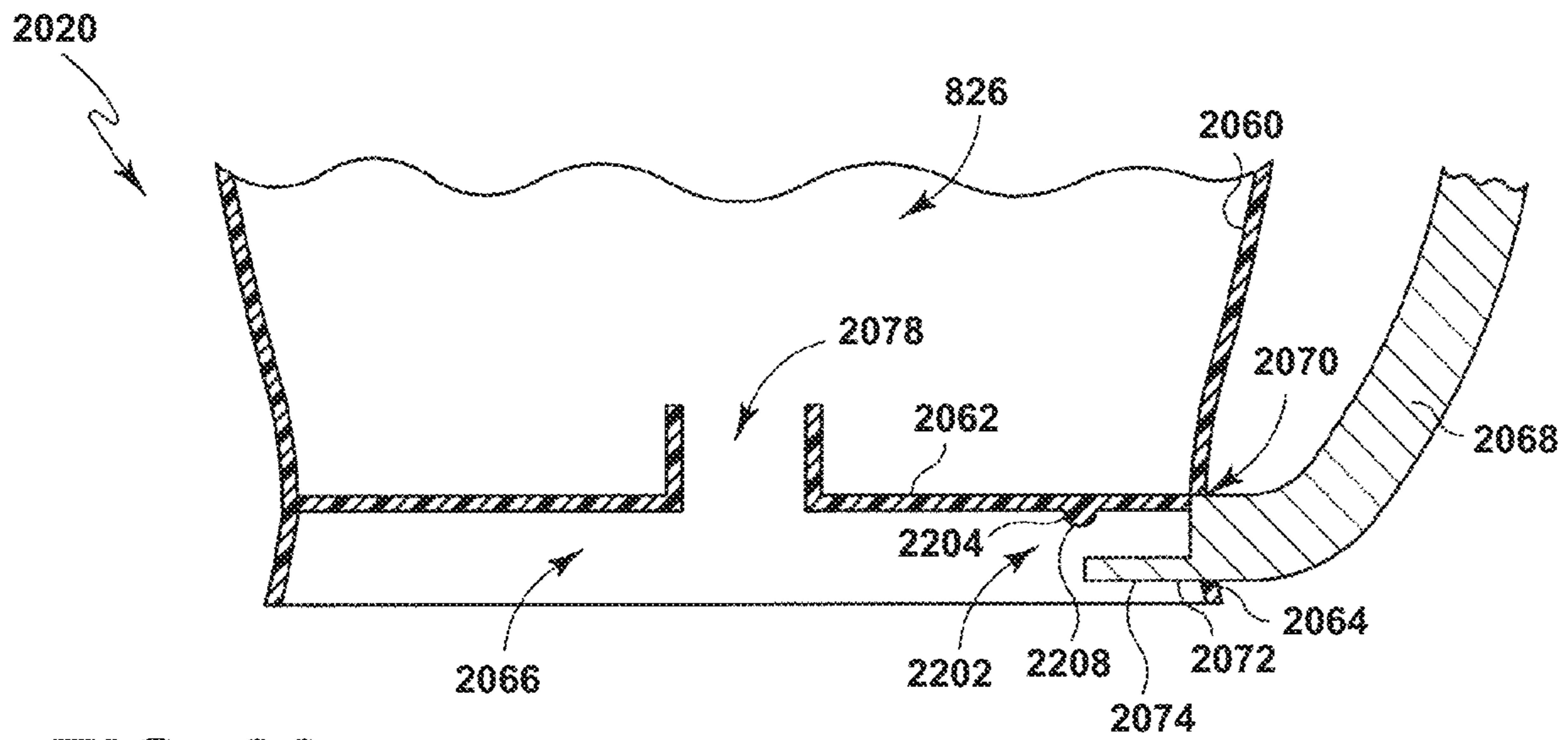


FIG. 39

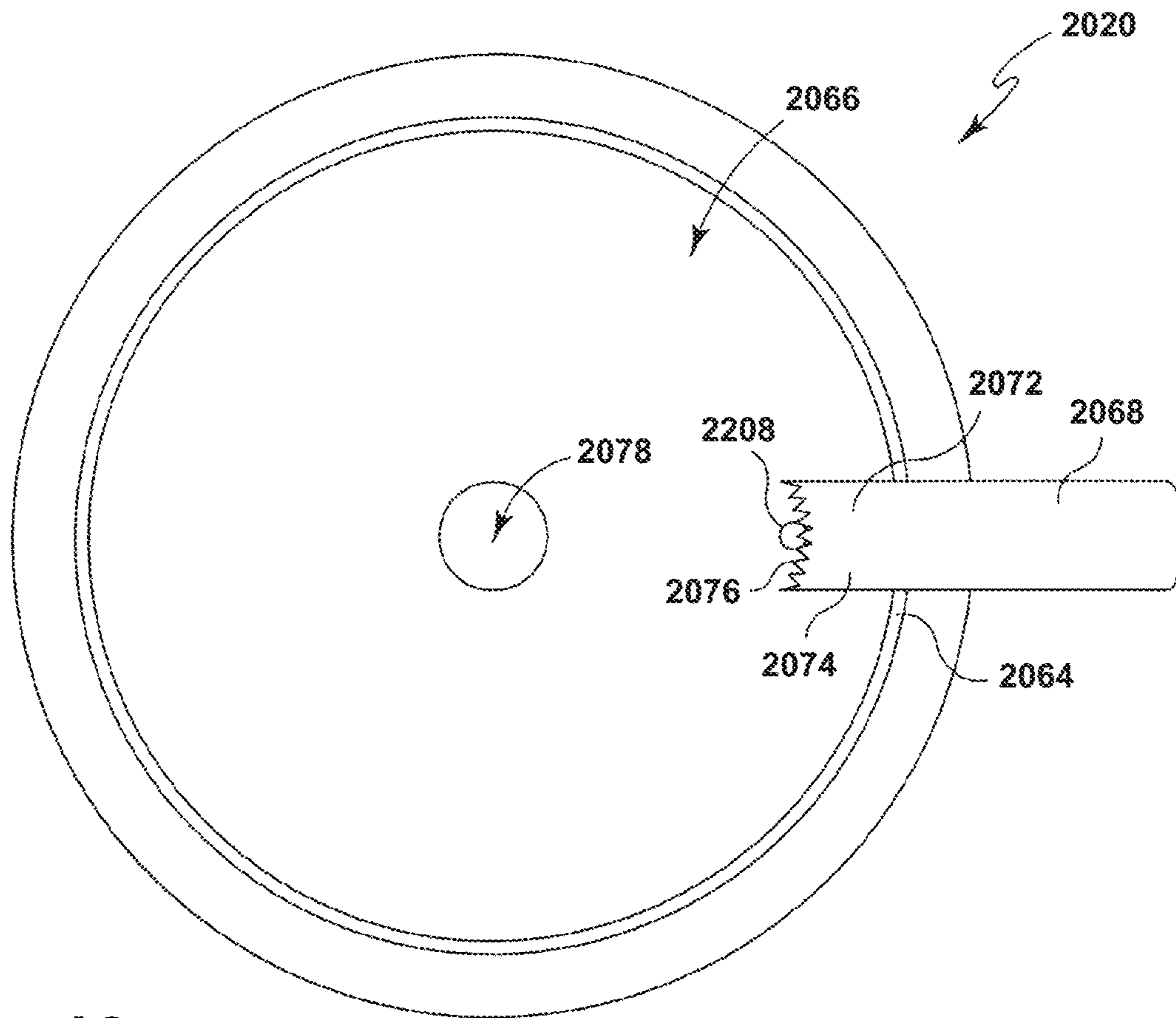


FIG. 40

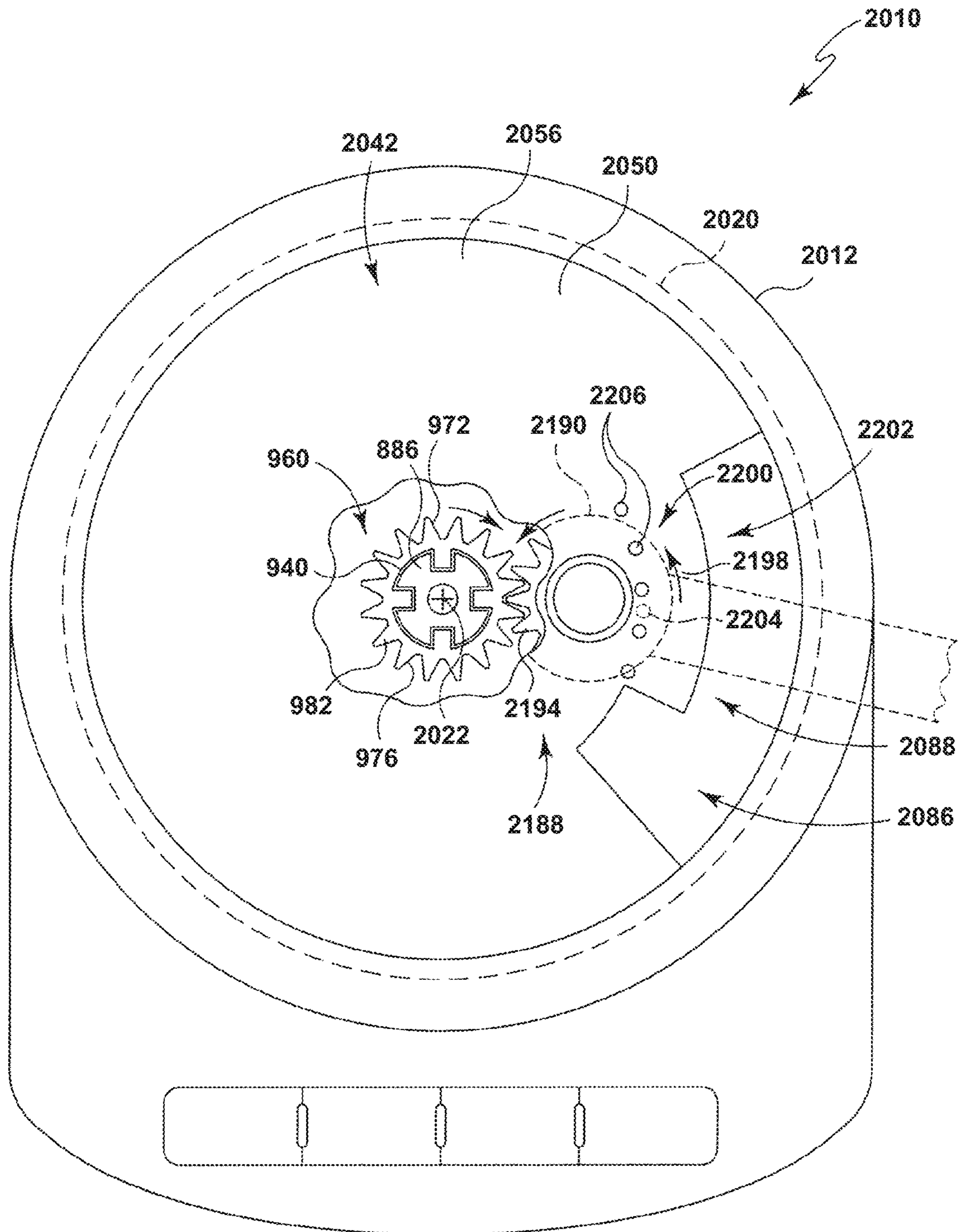


FIG. 41

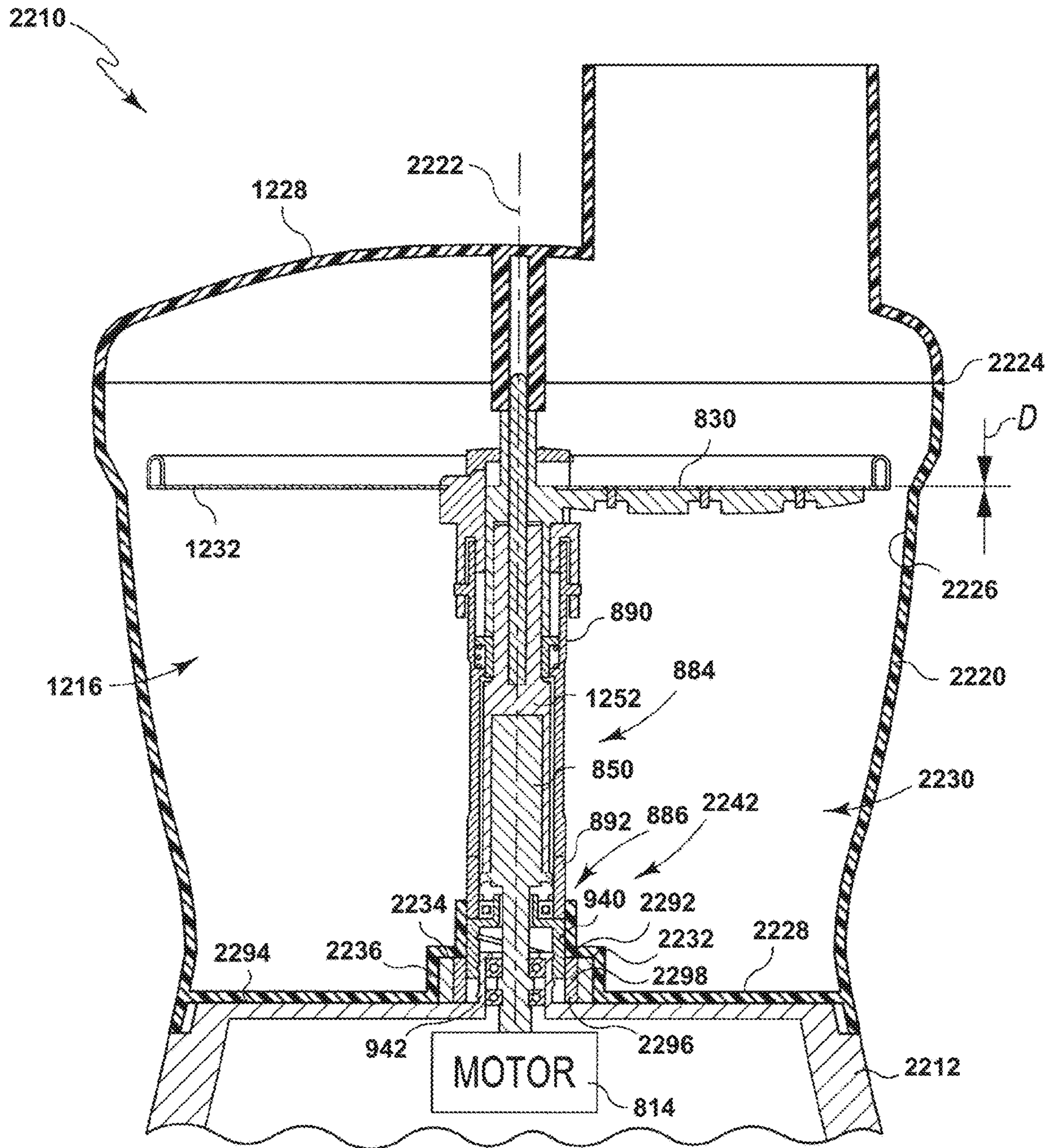


FIG. 42

## FOOD PROCESSOR WITH ADJUSTABLE BLADE ASSEMBLY

### CROSS-REFERENCE TO RELATED U.S. PATENT APPLICATIONS

The present application is a Continuation of U.S. patent application Ser. No. 15/370,434, now U.S. Pat. No. 10,449,685, filed on Dec. 6, 2016, entitled "FOOD PROCESSOR WITH ADJUSTABLE BLADE ASSEMBLY," which is a Continuation-in-Part of U.S. patent application Ser. No. 14/220,203, now U.S. Pat. No. 10,105,864, entitled "FOOD PROCESSOR WITH A LOCKABLE ADJUSTABLE BLADE ASSEMBLY," filed Mar. 20, 2014, which is a divisional of U.S. patent application Ser. No. 12/769,746, now U.S. Pat. No. 8,720,325, entitled "FOOD PROCESSOR WITH A LOCKABLE ADJUSTABLE BLADE ASSEMBLY," filed on Apr. 29, 2010.

U.S. patent application Ser. No. 15/370,434, now U.S. Pat. No. 10,449,685, is also a Continuation-in-Part of U.S. patent application Ser. No. 15/000,712, now U.S. Pat. No. 10,582,808, entitled "FOOD PROCESSING DEVICE WITH AN EXTERNALLY OPERATED ADJUSTMENT MECHANISM," filed Jan. 19, 2016, which is a divisional of U.S. patent application Ser. No. 14/000,416, now U.S. Pat. No. 9,265,381, entitled "FOOD PROCESSING DEVICE WITH AN EXTERNALLY OPERATED ADJUSTMENT MECHANISM," filed Sep. 23, 2013, which is a National Stage Entry of PCT/CN2011/001487 entitled "A FOOD PROCESSING DEVICE WITH AN EXTERNALLY OPERATED ADJUSTMENT MECHANISM," filed on Sep. 1, 2011.

U.S. patent application Ser. No. 15/370,434, now U.S. Pat. No. 10,449,685, is also a Continuation-in-Part of U.S. patent application Ser. No. 14/000,413, now U.S. Pat. No. 9,655,474, entitled "FOOD PROCESSING DEVICE WITH AN EXTERNALLY OPERATED ADJUSTMENT MECHANISM," filed on Sep. 23, 2013, which is a National Stage Entry of PCT/CN2011/000311, entitled "A FOOD PROCESSING DEVICE WITH AN EXTERNALLY OPERATED ADJUSTMENT MECHANISM," filed on Feb. 25, 2011.

Each of the above-identified applications are hereby incorporated by reference.

Cross-reference is made to U.S. Pat. No. 8,985,010, entitled "Food Processor With Cutting Blade Assembly Support," filed Apr. 29, 2010, and U.S. Pat. No. 8,439,285, entitled "Adjustable Food Processor With Guide Ramp," filed Apr. 29, 2010, each of which is assigned to the same assignee as the present application, each of which is hereby incorporated by reference.

### FIELD OF THE INVENTION

The present disclosure relates generally to a domestic food processor, and more particularly to a food processor having a control for adjusting the cutting thickness of the food processor.

### BACKGROUND OF THE INVENTION

A food processor is a motorized domestic appliance for manipulating (e.g., chopping, slicing, dicing, shredding, grating, or blending) food items. Such an appliance includes a bowl with a removable lid. Food items are inserted into the bowl through a feed tube formed in the lid where they are cut by motor-driven cutting tool.

Food processors typically come equipped with a number of interchangeable cutting tools for slicing, shredding, or other food processing operations. One common cutting tool is a rotating disk-type cutter. Such a cutting tool includes a rotating disk having a cutting blade fixed thereto. The cutting blade is secured to the rotating disk at a location adjacent to an aperture formed in the disk so that pieces of food cut by the blade fall through the aperture and collect in the bottom of the bowl.

### SUMMARY OF THE INVENTION

According to one aspect of this disclosure, a food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl. The lid has a feed tube that opens into the bowl. A cutting blade is positioned in the bowl and driven by the motor to cut food items advanced through the feed tube. The food processor also includes a rotating disk upwardly and downwardly movable relative to the cutting blade to adjust the distance therebetween, and a user-operated pin positioned below the rotating disk. The user-operated pin is movable between a first position in which the rotating disk is prevented from moving upwardly and downwardly relative to the cutting blade, and a second position in which the rotating disk is permitted to move upwardly and downwardly relative to the cutting blade. In some embodiments, the rotating disk may include a sleeve extending downwardly from a lower surface thereof, and the cutting blade may be coupled to a central shaft positioned in the sleeve of the rotating disk.

In some embodiments, the user-operated pin may include a pin body extending from a first end through a sidewall of the sleeve to a second end received in an aperture formed in the central shaft. In some embodiments, the sidewall of the sleeve may include a first plurality of teeth, an outer surface of the pin body may have a second plurality of teeth extending therefrom, and a number of the first plurality of teeth may be engaged with the second plurality of teeth when the user-operated pin is in the first position.

Additionally, in some embodiments, the first plurality of teeth may be spaced apart from the second plurality of teeth when the user-operated pin is moved to the second position. In some embodiments, the food processor may also include a spring having a first spring end positioned at a bottom of the aperture of the central shaft and a second spring end coupled to the second end of the user-operated pin. The spring may bias the user-operated pin in the first position. In some embodiments, a guide pin may extend outwardly from the bottom of the aperture, and the spring may extend over the guide pin.

In some embodiments, the food processor may also include a lever pivotably coupled to a sidewall of the sleeve and may have a first lever end contacting the second end of the user-operated pin. Movement of the user-operated pin between the first position and the second position may cause the lever to pivot about an axis between a first lever position and a second lever position. In some embodiments, the lever may extend from the first lever end to a second lever end. The second lever end may be coupled with the central shaft when the lever is at the first lever position. In some embodiments, the central shaft may have an outer surface with a plurality of teeth extending therefrom, and the second lever end may be engaged with a number of the plurality of teeth when the lever is at the first lever position, thereby preventing the rotating disk from moving relative to the cutting blade.

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In some embodiments, the second lever end may be spaced apart from the plurality of teeth at the second lever position, thereby permitting movement of the rotating disk relative to the cutting blade. In some embodiments, the food processor may also include a spring having a first end 5 coupled to a sidewall of the sleeve and a second end coupled to the second lever end. The spring may bias the lever in the first lever position, thereby maintaining the user-operated pin in the first position and preventing movement of the rotating disk relative to the cutting blade. Additionally, in some embodiments, a button may be secured to a first end of the user-operated pin, and depressing the button moves the user-operated pin from the first position to the second position.

According to another aspect, a food slicer assembly for a food processor is disclosed. The food slicer assembly includes a cutting blade, a rotating disk upwardly and downwardly movable relative to the cutting blade to adjust the distance therebetween, and a locking mechanism positioned below a lower surface of the rotating disk. The locking mechanism includes a user-operated pin that is movable between a first position in which the locking mechanism prevents the rotating disk from moving upwardly and downwardly relative to the cutting blade, and a second position in which the locking mechanism permits the rotating disk to move upwardly and downwardly relative to the cutting blade.

In some embodiments, the food slicer assembly may further include a sleeve extending downwardly from the lower surface of the rotating disk, and a central shaft positioned in the sleeve. The central shaft may have the cutting blade coupled thereto. In some embodiments, the locking mechanism may include a first plurality of teeth extending from a sidewall of the sleeve. The user-operated pin may extend through the sleeve into the central shaft and may have a second plurality of teeth extending therefrom. The second plurality of teeth may be engaged with a number of the first plurality of teeth when the user-operated pin is in the first position and spaced apart from the first plurality of teeth when the user-operated pin is moved to the second position.

In some embodiments, the locking mechanism may include a plurality of teeth extending from the central shaft, and a lever extending from a first end coupled to the user-operated pin to a second end. The second end of the lever may be engaged with a number of the teeth when the user-operated pin is in the first position and spaced apart from the plurality of teeth when the user-operated pin is in the second position. In some embodiments, the lever may be pivotably coupled to the sleeve.

According to another aspect, the food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, a cutting blade positioned in the bowl and secured to a central shaft driven by the motor, and a rotating disk having the central shaft extending there-through. The rotating disk is upwardly and downwardly movable between a plurality of positions relative to the cutting blade. The food processor also includes a locking mechanism positioned below a lower surface of the rotating disk. The locking mechanism includes a user-operated pin extending through the rotating disk that is movable between a first position in which the rotating disk is prevented from moving upwardly and downwardly relative to the cutting blade, and a second position in which the rotating disk is permitted to move upwardly and downwardly relative to the cutting blade.

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In some embodiments, the locking mechanism may include a first plurality of teeth extending from a sidewall of the rotating disk, and the user-operated pin may have a second plurality of teeth extending therefrom. The second plurality of teeth may be engaged with a number of the first plurality of teeth when user-operated pin is in the first position and spaced apart from the first plurality of teeth when the user-operated pin is moved to the second position.

According to another aspect of this disclosure, a food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. The food processor also includes a blade assembly positioned in the processing chamber and driven by the motor, and the blade assembly has a flange extending therefrom. A rotating disk is movably coupled to the blade assembly, and the rotating disk has a plurality of slots formed therein. Each of the slots is sized to receive the flange of the blade assembly. The rotating disk is movable relative to the blade assembly between a plurality of cutting positions to produce cut food items of varying thicknesses, and the flange of the blade assembly is received into one of the plurality of slots at each of the plurality of cutting positions.

In some embodiments, the rotating disk may include a blade support pivotably coupled to an outer rim of the rotating disk. The plurality of slots may be formed in the blade support. In some embodiments, the blade support may be movable between a first position where the flange of the blade assembly is received in one of the plurality of slots, and a second position where the flange of the blade assembly is spaced apart from each of the plurality of slots. Additionally, in some embodiments, the rotating disk may be prevented from moving relative to the blade assembly when the blade support is placed in the first position, and the rotating disk may be permitted to move relative to the blade assembly when the blade support is placed in the second position.

In some embodiments, the outer rim of the rotating disk may have an opening defined therein, and the blade support may have a body positioned in the opening when the blade support is placed in the first position. The body of the blade support may extend outwardly from the opening when the blade support is placed in the second position.

In some embodiments, the rotating disk may include a locking device configured to maintain the blade support in the first position. In some embodiments, the locking device may include a tab extending from the blade support, and the tab may be received in a recess formed in the outer rim of the rotating disk when the blade support is placed in the first position.

In some embodiments, the plurality of slots may include at least five slots. Additionally, in some embodiments, the blade assembly may include a cutting blade secured to a mounting arm extending from a central shaft. In some embodiments, the flange of the blade assembly received in one of the plurality of slots may be an outer edge of the cutting blade when the rotating disk is placed at a first cutting position, and the flange of the blade assembly received in one of the plurality of slots may be an arcuate lip of the mounting arm when the rotating disk is placed at a second cutting position.

According to another aspect, a food slicer assembly for a food processor is disclosed. The food slicer assembly includes a cutting blade having an outer edge, and a rotating disk movable to a plurality of positions relative to the cutting blade to adjust the distance therebetween. The rotating disk has an outer rim positioned adjacent to the outer edge of the

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cutting blade, and a blade support coupled to the outer rim, the blade support includes a plurality of slots, each of which is sized to receive the outer edge of the cutting blade. The outer edge of the cutting blade is received in a first slot at a first position of the rotating disk.

In some embodiments, the food slicer assembly may further include a central shaft secured to an inner edge of the cutting blade, and a mounting arm secured to the central shaft and positioned below the cutting blade. In some embodiments, the mounting arm may have an arcuate lip extending parallel to the outer edge of the cutting blade. The lip may be received in the first slot of the blade support at a second position of the rotating disk.

In some embodiments, the blade support may include a body extending from a first end, and the first end may be hinged to the outer rim of the rotating disk such that the blade support is rotatable about a vertical axis. In some embodiments, when the rotating disk is at the first position, the outer edge of the cutting blade may be received in the first slot when the blade support is placed at a first position about the vertical axis, and the outer edge of the cutting blade may be spaced apart from each of the plurality of slots when the blade support is placed at a second position about the vertical axis.

Additionally, the first end of the body of the blade support may be coupled to the outer rim of the rotating disk via a pivot joint. The pivot joint may have the vertical axis extending therethrough.

According to another aspect, a food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, a removable lid coupled to the bowl. The lid has a feed tube that opens into the bowl. A blade assembly is positioned in the bowl and is driven by the motor, and a rotating disk is movable between a plurality of cutting positions relative to the blade assembly. The rotating disk has a blade support that includes a slot corresponding to each of the plurality of cutting positions, each slot being sized to receive a flange of the blade assembly.

In some embodiments, the blade assembly may include a cutting blade having an outer edge. The rotating disk may have an outer rim positioned adjacent to the outer edge of the cutting blade, and the blade support may be pivotably coupled to the outer rim. In some embodiments, the blade support may be pivotable between a first position where the outer edge of the cutting blade is received in one slot of the blade support, and a second position where the outer edge of the cutting blade may be spaced apart from the blade support.

In some embodiments, the flange of the blade assembly received in one of the plurality of slots may be the outer edge of the cutting blade when the rotating disk is placed at a first cutting position.

According to another aspect of the disclosure, a food processing device is disclosed. The food processing device includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. The food processing device also includes a blade assembly positioned in the processing chamber, which is driven by the motor and includes a cutting blade to cut food items advanced through the feed tube, and a rotating disk upwardly and downwardly movable relative to the cutting blade to adjust the distance between an upper surface of the rotating disk and the cutting blade. The food processing device also includes an adjustment assembly operable to move the rotating disk relative to the cutting blade. The adjustment assembly includes a

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control knob coupled to the blade assembly and is positioned above the upper surface of the rotating disk, and a threaded sleeve coupled to the rotating disk and is positioned in the control knob.

5 In some embodiments, the rotating disk may divide the processing chamber into an upper compartment and a lower compartment, and the blade assembly may include a mounting arm having a ramp defined therein to guide food items from the upper compartment to the lower compartment. In some embodiments, the ramp may have an inclined surface extending outwardly in a radial direction from a first end to a second end.

10 The inclined surface may have a first angle of inclination at the first end and a second angle of inclination at the second end. In some embodiments, the first angle of inclination may be greater than or equal to the second angle of inclination. Additionally, in some embodiments, the first angle of inclination may be approximately 25 degrees. In some embodiments, the second angle of inclination may be approximately 15 degrees.

15 In some embodiments, the rotating disk may have a counterweight secured thereto, and the threaded sleeve may be positioned between the mounting arm and the counterweight. In some embodiments, rotation of the control knob in a first direction may cause upward movement of the rotating disk, and rotation of the control knob in a second direction may cause downward movement of the rotating disk.

20 In some embodiments, the blade assembly may include a central shaft coupled to the control knob, and the central shaft may be received in the threaded sleeve. Rotation of the control knob may cause the threaded sleeve to move upwardly and downwardly along the central shaft.

25 According to another aspect, a food slicer assembly for a food processor is disclosed. The food slicer assembly includes a cutting blade, a mounting arm, which has a ramp defined therein, that is positioned below the cutting blade, and a rotating disk movable to a plurality of positions relative to the cutting blade to adjust the distance between its upper surface and the cutting blade. An adjustment assembly is operable to move the rotating disk relative to the cutting blade. The adjustment assembly includes an internally-threaded control knob positioned above the upper surface of the rotating disk, and an externally-threaded sleeve coupled to the rotating disk that is positioned in the control knob.

30 In some embodiments, the food slicer assembly may further include a central shaft that is coupled at an upper end to the control knob and is positioned in the sleeve. The mounting arm may extend outwardly from a first end secured to the central shaft to a second end positioned adjacent to an outer rim of the rotating disk. In some embodiments, the ramp may have an inclined surface extending in a radial direction from the first end of the mounting arm to the second end of the mounting arm. The inclined surface may have a first angle of inclination at the first end that is greater than or equal to a second angle of inclination at the second end. In some embodiments, the rotating disk may include a counterweight, and the sleeve may be positioned between the counterweight and the mounting arm.

35 According to another aspect, a food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. A cutting blade is positioned in the bowl and driven by the motor to cut food items advanced through the feed tube. A rotating disk is upwardly and

downwardly movable relative to the cutting blade to adjust the distance therebetween. The rotating disk divides the processing chamber into an upper compartment and a lower compartment. A ramp is positioned below the cutting blade to guide food items from the upper compartment into the lower compartment. The food processor further includes an adjustment assembly operable to move the rotating disk relative to the cutting blade. The adjustment assembly includes a user-operated control device positioned above the rotating disk.

In some embodiments, the adjustment assembly may include an externally-threaded sleeve coupled to the rotating disk, and the user-operated control device may include an internally-threaded control knob having a grip.

According to another aspect of the disclosure, a food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl so as to define a processing chamber. The removable lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly positioned in the processing chamber that is driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. The food processor also includes an adjustment assembly positioned in the base. The adjustment assembly includes a first sleeve secured to the base, a second sleeve rotatably coupled to the first sleeve, and a user-operated control device operable to rotate the second sleeve relative to the first sleeve to move the cutting assembly between the plurality of cutting positions. In some embodiments, the first sleeve may have an externally-threaded body, and the second sleeve may have an internally-threaded body positioned over the externally-threaded body of the first sleeve.

In some embodiments, the cutting assembly may include a cutting blade and a rotating disk that may be supported by the second sleeve. In some embodiments, rotation of the second sleeve in a first direction may cause upward movement of the second sleeve and the rotating disk relative to the cutting blade, and rotation of the second sleeve in a second direction may cause downward movement of the second sleeve and the rotating disk relative to the cutting blade.

Additionally, in some embodiments, the food processor may further include a drive shaft connected at a first end to the motor and at a second end to the cutting assembly to transmit a driving force from the motor to the cutting assembly. In some embodiments, the first sleeve may include a bearing rotatably supporting the drive shaft, and the drive shaft may extend through an opening defined in the second sleeve. The opening may be sized such that the drive shaft does not contact the second sleeve.

In some embodiments, the food processor may further include a first adaptor removably coupled to the rotating disk, and a second adaptor secured to a lower end of the first adaptor. The second sleeve may include a bearing rotatably supporting the second adaptor. In some embodiments, the lower end of the first adaptor may include a first plurality of teeth, and the second adaptor may include a second plurality of teeth interdigitated with the first plurality of teeth to secure the second adaptor to the first adaptor.

Additionally, in some embodiments, the adjustment assembly may further comprise a gear assembly positioned in the base and coupled to the second sleeve. The gear assembly may be operable to rotate the second sleeve relative to the first sleeve. The user-operated control device may be coupled to the gear assembly and be configured to operate the gear assembly such that the second sleeve is

rotated relative to the first sleeve to move the cutting assembly between the plurality of cutting positions.

In some embodiments, the second sleeve may have a groove defined therein. The gear assembly may have a first gear including a first plurality of teeth defined on an outer surface and a spline extending from an inner surface thereof. The spline may be received in the groove of the second sleeve. A second gear including a second plurality of teeth may be interdigitated with the first plurality of teeth. The user-operated control device may cause rotation of the second gear and the first gear.

In some embodiments, the user-operated control device may include a lever extending outwardly from the base and positionable between a plurality of adjustment positions relative to the base. The lever may be coupled to the second gear such that movement of the lever between the plurality of adjustment positions may cause rotation of the second sleeve relative to the first sleeve to move the cutting assembly between the plurality of cutting positions.

In some embodiments, the food processor may further include a locking mechanism to inhibit movement of the lever. Additionally, in some embodiments, the locking mechanism may include a plurality of notches formed in the second gear, and each notch may correspond to one of the plurality of adjustment positions. The locking mechanism may also include a pin positioned below the second gear that is configured to be received in each of the plurality of notches, and a spring coupled to the pin. The spring may bias the pin into the notch corresponding to a present adjustment position of the lever to inhibit movement of the lever.

According to another aspect, the food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly, which is positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly includes a cutting blade and a rotating disk having an upper surface. The rotating disk is upwardly and downwardly movable relative to the cutting blade to adjust the distance between the upper surface of the rotating disk and the cutting blade. The food processor also has an adjustment assembly including a screw-type drive assembly positioned in the base. The screw-type drive assembly is operable to move the rotating disk relative to the cutting blade while the rotating disk and the cutting assembly is driven by the motor.

In some embodiments, the screw-type drive assembly may support the rotating disk. Rotation of the screw-type drive assembly in a first direction may cause upward movement of the rotating disk, and rotation of the screw-type drive assembly in a second direction may cause downward movement of the rotating disk.

In some embodiments, the screw-type drive assembly may include an externally-threaded first sleeve and an internally-threaded second sleeve positioned over the first sleeve. The rotating disk may be supported by the second sleeve such that rotation of the second sleeve in the first direction may cause upward movement of the second sleeve and the rotating disk and rotation of the second sleeve in the second direction may cause downward movement of the second sleeve and the rotating disk.

In some embodiments, the adjustment assembly may further include a gear assembly positioned in the base and coupled to the second sleeve. The gear assembly may be configured to rotate the second sleeve relative to the first sleeve. Additionally, in some embodiments, the adjustment

assembly may further include a lever coupled to the screw-type drive assembly. The lever may extend outwardly from the base and be movable relative to the base, and movement of the lever may cause the screw-type drive assembly to move the rotating disk relative to the cutting blade. In some embodiments, the food processor may include a locking mechanism to inhibit movement of the lever.

According to another aspect, the food processor includes a base having a motor positioned therein, a removable bowl coupled to the base, and a removable lid coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. A cutting assembly is positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. An adjustment assembly is positioned in the base that is operable to move the cutting assembly between the plurality of cutting positions while the cutting assembly is driven by the motor.

In some embodiments, the adjustment assembly may include a lever extending outwardly from the base. The lever may be positionable between a plurality of adjustment positions corresponding to the plurality of cutting positions of the cutting assembly such that movement of the lever between the plurality of adjustment positions moves the cutting assembly between the plurality of cutting positions. In some embodiments, the adjustment assembly may include a screw-type drive assembly operable to move the cutting assembly between the plurality of cutting positions, and a second motor rotatably coupled to the screw-type drive assembly. The second motor may be configured to operate the screw-type drive assembly to move the cutting assembly between the plurality of cutting positions when the second motor is energized.

According to another aspect, a food processor includes a base having a motor positioned therein, a bowl removably coupled to the base, and a lid removably coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. The food processor includes an adjustment assembly that is operable to move the cutting assembly between the plurality of cutting positions while the cutting assembly is driven by the motor. The adjustment assembly includes a sleeve rotatably coupled to the base, a gear assembly positioned in the base and operable to rotate the sleeve, and a user-operated control device configured to operate the gear assembly to rotate the sleeve. In the food processor, rotation of the sleeve causes the cutting assembly to move between the plurality of cutting positions while the cutting assembly is driven by the motor.

In some embodiments, the user-operated control device may include a control knob having a grip and a shaft extending inwardly from the control knob into the base.

In some embodiments, the cutting assembly may include a cutting blade and a rotating disk. Rotation of the sleeve in a first direction may cause upward movement of the rotating disk relative to the cutting blade, and rotation of the sleeve in a second direction may cause downward movement of the rotating disk relative to the cutting blade.

Additionally, in some embodiments, the gear assembly may include a first gear including a first plurality of teeth, and the first gear may be movably coupled to the sleeve such that rotation of the first gear causes rotation of the sleeve.

The gear assembly may also include a second gear including a second plurality of teeth interdigitated with the first plurality of teeth such that rotation of the second gear causes rotation of the first gear. In some embodiments, the first gear may be a worm gear.

In some embodiments, the user-operated control device may include a grip formed on the second gear, and the grip may be operable by a user to rotate the second gear.

In some embodiments, the user-operated control device may include a ring having a third plurality of teeth defined on an inner surface. The third plurality of teeth may be interdigitated with a number of the second plurality of teeth such that rotation of the ring causes rotation of the second gear. In some embodiments, the bowl may include a lower rim and the ring may be rotatably coupled to the lower wall of the bowl. In some embodiments, the ring may have a grip formed thereon that is operable by a user to rotate the ring.

Additionally, in some embodiments, the food processor may also include a drive shaft configured to transmit a driving force from the motor to the cutting assembly. The drive shaft may extend through an opening defined in the sleeve, and the opening may be sized such that the sleeve is spaced apart from the drive shaft.

In some embodiments, the user-operated control device may include a lever extending outwardly from the base and movable relative to the base. The lever may be coupled to the gear assembly such that movement of the lever relative to the base causes the gear assembly to rotate the sleeve.

According to another aspect, the food processor includes a base having a motor positioned therein, a bowl removably coupled to the base, and a lid removably coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. The food processor also includes an adjustment assembly having a user-operated control device that is operable to move the cutting assembly between the plurality of cutting positions while the cutting assembly is driven by the motor. The user-operated control device includes a shaft extending outwardly from the base and a control knob coupled to the shaft, and rotation of the control knob causes the cutting assembly to move between the plurality of cutting positions while the cutting assembly is driven by the motor.

In some embodiments, the adjustment assembly may include a gear assembly located in the base that is operable to move the cutting assembly between the plurality of cutting positions. Rotation of the control knob may cause the gear assembly to move the cutting assembly between the plurality of cutting positions.

In some embodiments, the adjustment assembly may further include an adaptor having a first end coupled to the cutting assembly, and a sleeve rotatably coupled to the base and to a second end of the adaptor. The sleeve may have an inner surface with a groove defined therein. The gear assembly of the food processor may include a first gear including a first plurality of teeth defined on an outer surface and a spline extending from an inner surface. The spline may be received in the groove of the sleeve such that rotation of the first gear causes rotation of the sleeve.

In some embodiments, the gear assembly may include a rack and pinion configured to translate rotation of the control knob into rotation of the first gear. In some embodiments, the rack may include a second plurality of teeth interdigitated



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with the first plurality of teeth of the first gear. Additionally, in some embodiments, the control knob may be secured to a first end of the shaft and the pinion may be secured to a second end of the shaft. The pinion may include a third plurality of teeth interdigitated with a fourth plurality of teeth defined on the rack.

In some embodiments, the first gear may be a worm gear and the gear assembly may include a second gear including a second plurality of teeth interdigitated with a number of the first plurality of teeth of the worm gear.

In some embodiments, the cutting assembly may include a cutting blade and a rotating disk, and rotation of the control knob in a first direction may cause upward movement of the rotating disk relative to the cutting blade, and rotation of the control knob in a second direction may cause downward movement of the rotating disk relative to the cutting blade.

According to another aspect, a food processor includes a base having a motor positioned therein, a bowl removably coupled to the base, and a lid removably coupled to the bowl so as to define a processing chamber. The lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. The food processor also includes an adjustment assembly that has a gear assembly positioned in the base and a user-operated control device. The gear assembly is operable to move the cutting assembly between the plurality of cutting positions while the cutting assembly is driven by the motor. The user-operated control device includes a thumbwheel positioned in a slot defined in the base. The thumbwheel is configured to operate the gear assembly to move the cutting assembly.

According to another aspect, a food processor includes a base having a motor positioned therein, a bowl removably coupled to the base, and a lid removably coupled to the bowl so as to define a processing chamber. The bowl is configured to rotate relative to the base about an axis, and the lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly includes a cutting blade and a rotating disk having an upper surface. The rotating disk is movable relative to the cutting blade to adjust a distance defined between the upper surface of the rotating disk and the cutting blade. The food processor also includes an adjustment assembly positioned in the base. The adjustment assembly is operable to move the rotating disk relative to the cutting blade while the cutting assembly is driven by the motor. The bowl is configured to engage the adjustment assembly such that rotation of the bowl in a first direction about the axis causes upward movement of the rotating disk relative to the cutting blade, and rotation of the bowl in a second direction causes downward movement of the rotating disk relative to the cutting blade.

In some embodiments, the adjustment assembly may include an adaptor coupled to the rotating disk, a sleeve rotatably coupled to the adaptor and to the base, and a gear assembly positioned in the base. The gear assembly may be configured to translate rotation of the bowl into rotation of the sleeve. Rotation of the sleeve may cause movement of the rotating disk relative to the cutting blade.

In some embodiments, the sleeve may have a groove defined therein. The gear assembly may include a first gear including a first plurality of teeth defined on an outer surface and a spline extending from an inner surface. The spline may

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be received in the groove of the sleeve such that rotation of the first gear causes rotation of the sleeve. The gear assembly may also include a second gear including a second plurality of teeth interdigitated with the first plurality of teeth such that rotation of the second gear causes rotation of the first gear.

Additionally, in some embodiments, the bowl may include a third plurality of teeth that are interdigitated with a number the second plurality of teeth of the second gear such that rotation of the bowl about the axis causes rotation of the second gear. In some embodiments, the bowl may include an inner wall and an arm extending inwardly from the inner wall to a first end. The first end of the arm may have the third plurality of teeth defined thereon.

In some embodiments, the base may have a slot defined therein sized to receive the first end of the arm. Additionally, in some embodiments, the slot may include a first section in which the bowl is engaged with the adjustment assembly and a second section in which the bowl is disengaged with the adjustment assembly.

In some embodiments, the food processor may further include a drive shaft configured to transmit a driving force from the motor to the cutting assembly, and the drive shaft may extend through an opening defined in the sleeve. The opening may be sized such that the sleeve is spaced apart from the drive shaft. Additionally, in some embodiments, the food processor may include a drive stem coupled to the drive shaft. The cutting assembly may further include a blade carrier having the cutting blade secured thereto, and the drive stem may have a keyed end that is received in a corresponding socket defined in the blade carrier. In some embodiments, the lid may include a sleeve that contacts an upper end of the blade carrier to position the blade carrier on the drive stem.

In some embodiments, the food processor may further include a locking mechanism configured to inhibit rotation of the bowl about the axis. In some embodiments, the locking mechanism may include a pin extending from a lower surface of the bowl, and a plurality of notches defined in an upper surface of base. Each notch may be sized to receive the pin of the bowl.

According to another aspect, a food processor includes a base having a motor positioned therein, a bowl removably coupled to the base, and a lid removably coupled to the bowl so as to define a processing chamber. The bowl is configured to rotate relative to the base about an axis, and the lid has a feed tube that opens into the bowl. The food processor also includes a cutting assembly positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. The food processor includes an adjustment assembly attached to the base. The adjustment assembly is operable to move the cutting assembly between the plurality of cutting positions while the cutting assembly is driven by the motor. The bowl is configured to engage the adjustment assembly such that rotation of the bowl about the axis operates the adjustment assembly to move the cutting assembly between the plurality of cutting positions.

In some embodiments, the adjustment assembly may include an adaptor coupled to the cutting assembly, a sleeve rotatably coupled to the adaptor and to the base, and a gear rotatably coupled to the base. The gear may be configured to translate rotation of the bowl into rotation of the sleeve, and rotation of the sleeve may cause movement of the cutting assembly between the plurality of cutting positions.

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In some embodiments, the sleeve may have a groove defined therein, and the gear may include a first plurality of teeth defined on an outer surface and a spline extending from an inner surface. The spline may be received in the groove of the sleeve such that rotation of the gear causes rotation of the sleeve, and the bowl may include a second plurality of teeth that are interdigitated with the first plurality of teeth such that rotation of the bowl causes rotation of the gear.

In some embodiments, the adaptor may include a first adaptor removably coupled to the cutting assembly and a second adaptor torsionally secured to a lower end of the first adaptor. The sleeve may include a bearing rotatably supporting the second adaptor. Additionally, in some embodiments, the lower end of the first adaptor may include a first plurality of teeth. The second adaptor may include a second plurality of teeth interdigitated with the first plurality of teeth to torsionally secure the second adaptor to the first adaptor.

In some embodiments, the gear may be a first gear movably coupled to the sleeve such that rotation of the first gear causes rotation of the sleeve. The first gear may include a first plurality of teeth, and the adjustment assembly may further include a second gear including a second plurality of teeth interdigitated with the first plurality of teeth such that rotation of the second gear causes rotation of the first gear.

In some embodiments, the bowl may include an inner wall and an arm extending inwardly from the inner wall to a first end. The first end of the arm may have a third plurality of teeth defined thereon that are interdigitated with the second plurality of teeth of the second gear such that rotation of the bowl about the axis causes rotation of the second gear.

According to another aspect, a food processor includes a base having a motor positioned therein, a bowl removably coupled to the base, and a lid removably coupled to the bowl so as to define a processing chamber. The bowl is configured to rotate about an axis relative to the base, and the lid has a feed tube that opens into the bowl. A cutting assembly is positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube. The cutting assembly is positionable between a plurality of cutting positions to produce cut food items of varying thicknesses. The food processor also includes an adjustment assembly having a gear assembly positioned in the base, and the gear assembly is operable to move the cutting assembly between the plurality of cutting positions while the cutting assembly is driven by the motor. The bowl is configured to engage the gear assembly such that rotation of the bowl about the axis relative to the base operates the adjustment assembly to move the cutting assembly between the plurality of cutting positions.

## BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the following figures, in which:

FIG. 1 is a perspective view of a food processor;

FIG. 2 is a partial cross-sectional view of the food processor of FIG. 1;

FIG. 3 is a view similar to FIG. 2, showing the rotating disk of the food slicer assembly of FIG. 2 in another position relative to the cutting blade;

FIG. 4 is a perspective view of the food slicer assembly of FIG. 2;

FIG. 5 is a partial cross-sectional view of the food slicer assembly of FIG. 2 taken along the line 5-5 shown in FIG. 4;

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FIG. 6 is a fragmentary perspective view of a blade support of the food slicer assembly of FIG. 2;

FIG. 7 is a partial cross-sectional view of another embodiment of a food processor;

FIG. 8 is a view similar to FIG. 7, showing the rotating disk of the food slicer assembly of FIG. 7 in another position relative to the cutting blade;

FIG. 9 is a perspective view of a food processor;

FIG. 10 is a partial cross-sectional view of the food processor of FIG. 1;

FIG. 11 is a view similar to FIG. 10, showing the rotating disk of the food slicer assembly of FIG. 10 in another position relative to the cutting blade;

FIG. 12 is a perspective view of the food slicer assembly of FIG. 10;

FIG. 13 is a partial cross-sectional view of the food slicer assembly of FIG. 10 taken along the line 13-13 shown in FIG. 12;

FIG. 14 is a fragmentary perspective view of a blade support of the food slicer assembly of FIG. 10;

FIG. 15 is a partial cross-sectional view of another embodiment of a food processor;

FIG. 16 is a view similar to FIG. 15, showing the rotating disk of the food slicer assembly of FIG. 15 in another position relative to the cutting blade;

FIG. 17 is a perspective view of a food processor;

FIG. 18 is a partial cross-sectional view of the food processor of FIG. 17;

FIG. 19 is a view similar to FIG. 18, showing the rotating disk of the food slicer assembly in another position relative to the cutting blade;

FIG. 20 is a perspective view of a food slicer assembly of the food processor of FIG. 17;

FIG. 21 is a partial cross sectional view of the food slicer assembly of FIG. 20 taken along the line 21-21; and

FIG. 22 is a partial cross sectional view of the food slicer assembly of FIG. 20 taken along the line 22-22 showing the angle of inclination of the ramp;

FIG. 23 is a perspective view of a food processor;

FIG. 24 is an exploded, partial cross-sectional perspective view of the food processor of FIG. 23;

FIG. 25 is a partial cross-sectional side elevation view of the food processor of FIG. 23 showing a cutting assembly that includes a rotating disk and a cutting blade;

FIG. 26 is a view similar to FIG. 25 showing the rotating disk in another position relative to the cutting blade;

FIG. 27 is an exploded, partial cross-sectional perspective view of the base of the food processor of FIG. 23;

FIG. 28 is a partial cross-sectional view of the base of the food processor of FIG. 23 taken along the line 28-28 of FIG. 27;

FIG. 29 is a perspective view of another embodiment of a food processor;

FIG. 30 is a partial cross-sectional side elevation view of the food processor of FIG. 23 including another embodiment of a cutting assembly and removable lid;

FIG. 31 is a partial cross-sectional side elevation view of the food processor similar to FIG. 30;

FIG. 32 is a partial cross-sectional perspective view of another embodiment of a base for a food processor;

FIG. 33 is a perspective view of another embodiment of a food processor;

FIG. 34 is a partial cross-sectional perspective view of the food processor of FIG. 33;

FIG. 35 is a partial cross-sectional perspective view of another embodiment of a base for the food processor of FIG. 33;

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FIG. 36 is a perspective view of another embodiment of a food processor;

FIG. 37 is a cross-sectional top plan view of the food processor of FIG. 36;

FIG. 38 is a perspective view of another embodiment of a food processor showing another embodiment of a base;

FIG. 39 is a cross-sectional side elevation view of another embodiment of a removable bowl for use with the base of FIG. 38;

FIG. 40 is a bottom plan view of the removable bowl of FIG. 39;

FIG. 41 is a top plan view of the removable bowl of FIG. 39 attached to the base of FIG. 38; and

FIG. 42 is a cross-sectional elevation view of another embodiment of a food processor.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the concepts of the present disclosure are susceptible to various modifications and alternative forms, specific exemplary embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit the concepts of the present disclosure to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

Referring to FIGS. 1-6, a food processor 10 is shown. One example of a food processor is the KitchenAid® 12-Cup Ultra Wide Mouth™ Food Processor, Base Model No. KFPW760OB, which is commercially available from Whirlpool Corporation of Benton Harbor, Mich., U.S.A. The food processor 10 has a base 12 that houses a motor 14 (shown schematically in FIG. 2) and a control unit (not shown). Under the control of the control unit, the motor's output shaft 16 drives a cutting blade 18 (see FIG. 2) to cut food items such as cheeses, meats, fruits, and vegetables. The base 12 also includes one or more buttons, switches, dials, or other types of controls 20. A user operates the controls 20 to control the operation of the motor 14 and hence the food processor 10. For instance, one of the controls 20 may be operable to turn the motor 14 on and off, while another control 20 may change the motor's speed.

As will be understood by those skilled in the art, the control unit may comprise analog and/or digital circuitry to process electrical signals received from the motor 14 (or other components of the food processor 10) and provide electrical control signals to the motor or other components of the food processor 10. For example, the control unit may be embodied as a microcontroller that executes firmware routines to control the operation of the food processor 10.

A removable bowl 22 is secured to the base 12. The bowl's handle facilitates placement of the bowl 22 on the base 12. The bowl 22 includes a removable lid 26 secured to its upper peripheral edge. The lid 26 has a feed tube 28 formed thereon through which food items such as cheeses, meats, fruits, and vegetables are inserted into the bowl 22 to be processed by the food processor 10. Collectively, the lid 26 and the bowl 22 define a processing chamber 24 where food items are processed by the cutting blade 18.

The bowl 22, lid 26, and feed tube 28 are generally made of a transparent or translucent plastic material, so that the contents of the food processor 10 can be viewed by a user without removing the lid 26 from the bowl 22. Moreover,

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one or more locking mechanisms may be used to lock the bowl to the base 12 and the lid 26 to the bowl 22.

As shown in FIGS. 2 and 3, when the removable bowl 22 is secured to the base 12, the output shaft 16 of the motor 14 is coupled to a drive stem 30. The drive stem 30 is in turn coupled to a food slicer assembly 32. As shown in FIGS. 2-4, the food slicer assembly 32 includes a rotating disk 34 and a blade assembly 36, with the cutting blade 18 being one component thereof. The rotating disk 34 effectively divides the processing chamber 24 into an upper compartment 38 located between the disk 34 and the lid 26, and a lower compartment 40 located below the rotating disk 34. A vertical distance, D, between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34 defines a cutting thickness. In other words, the thickness of the pieces of food items cut by the food processor 10 is determined by the distance D between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34. When the distance D between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34 is increased, thicker pieces of food items are created, with thinner pieces of food items being created when the distance D between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34 is decreased. As will be discussed in greater detail below, the rotating disk 34 is movable upwardly or downwardly between a plurality of cutting positions relative to the cutting blade 18 to vary the cutting thickness of the food processor 10, thereby creating thicker or thinner pieces of cut food items.

As shown in FIGS. 2-5, the blade assembly 36 includes a central shaft 46 that extends from a lower end 48 to an upper end 50. The lower end 48 receives the drive stem 30, thereby coupling the slicer assembly 32 to the output shaft 16 such that the slicer assembly 32 may be driven by the motor 14. The blade assembly 36 also includes a hub 52 positioned at the upper end 50 of the central shaft 46. As shown in FIG. 2, a tip 54 of the hub 52 is received in a guide sleeve 56 extending downward from the underside of the lid 26.

An inner edge 58 of the cutting blade 18 is received in a slot 60 formed between the hub 52 and the upper end 50 of the central shaft 46. As shown in FIGS. 2 and 3, the cutting blade 18 is secured within the slot 60 such that substantial deflection of the cutting blade 18 is inhibited when the cutting blade 18 cuts food items in the processing chamber 24. The cutting blade 18 is also secured to a mounting arm 62 extending away from the upper end 50 of the central shaft 46 to an end 64. A number of fasteners 66 (i.e., screws) positioned at a rear edge 68 of the cutting blade 18 extend into the mounting arm 62, thereby rigidly securing the cutting blade 18 to the mounting arm 62. It will be appreciated that in other embodiments the fasteners 66 may take the form of T-stakes, pins, posts, or other structures capable of securing the cutting blade 18 to the mounting arm 62. Additionally, the mounting arm 62 may include an overmold that receives the cutting blade 18.

As shown in FIGS. 2 and 3, the blade assembly 36 also includes a pair of flanges 70 extending beyond the end 64 of the mounting arm 62. One of the flanges 70 is an outer edge 72 of the cutting blade 18. Another flange 70 is an arcuate-shaped lip 74 extending outwardly from the end 64 of the mounting arm 62 that is parallel to the outer edge 72 of the cutting blade 18. As will be discussed in greater detail below, at least one of the flanges 70 is received in one of a plurality of slots 76 formed in the rotating disk 34 at each of the cutting positions.

The rotating disk 34 includes a planar body 80 and a central sleeve 82 extending downwardly from a lower surface 84 thereof. It will be appreciated that one or more of the components of the rotating disk 34 may be formed from plastic or a metallic material. The rotating disk 34 includes a passageway 86 that extends through the sleeve 82 and receives the central shaft 46 of the blade assembly 36. The planar body 80 also has a contoured opening 88 extending from the upper surface 44 to the lower surface 84. The contoured opening 88 is sized to receive the mounting arm 62 of the blade assembly 36. When the blade assembly 36 is positioned in the rotating disk 34, a gap or throat 92 is defined between the cutting edge 42 and the body 80, as shown in FIG. 4.

During operation, the motor 14 causes the blade assembly 36 to rotate. The blade assembly 36 acts on a sidewall 94 of the sleeve 82 such that the rotating disk 34 and the blade assembly 36 rotate together. Food items inserted through the feed tube 28 are urged into contact with the upper surface 44 of the rotating disk 34 while being acted upon (i.e., cut) by the cutting blade 18. Cut food items, along with other food items small enough to fit within the throat 92, pass from the upper compartment 38 into the lower compartment 40 through the throat 92.

As best seen in FIGS. 2, 3 and 5, the mounting arm 62 has a ramp 95 defined therein, which guides food items from the throat 92 into the lower compartment 40 of the bowl 22. The surface 96 of the ramp 95 is sloped downward from an upper end 97 positioned adjacent to the cutting edge 42 to a lower end 98. As shown in FIG. 5, the surface 96 extends radially outward from the central shaft 46 to the end 64 of the mounting arm 62. The angle of inclination or slope of the surface 96 changes along the radially length of the surface 96, increasing from approximately 15 degrees at the end 64 to approximately 25 degrees near the central shaft 46. As shown in FIG. 5, the surface 96 has an angle of inclination  $\alpha$  of approximately 22 degrees. In other embodiments, the surface 96 may be convex or concave in one or more directions. The central shaft 46 and the end 64 of the mounting arm 62 act as sidewalls for the surface 96 such that food items entering the throat 92 are guided down the ramp 95. In that way, the surface 96 is encapsulated or captured, thereby reducing the potential for food items to travel outside of the processing path and thus reducing unwanted debris.

A rim 90 extends upwardly from the outer perimeter of the disk's planar body 80. The rotating disk 34 has a diameter that is slightly less than the inner diameter of the bowl 22 such that the rim 90 is positioned adjacent to, but spaced slightly apart from, the inner wall of the bowl to permit rotation of the disk 34 within the bowl 22. The rotating disk 34 also includes a blade support 100 pivotably coupled to the rim 90.

As best seen in FIG. 6, the blade support 100 has the plurality of slots 76 formed therein. Each of the slots 76 extends parallel to the outer edge 72 of the cutting blade 18, and each of the slots 76 is sized to receive one of the flanges 70. In the illustrative embodiment, five slots 76 are formed in the blade support 100, and the slots 76 are spaced apart from each other by two millimeters. It will be appreciated that in other embodiments the blade support 100 may include additional or fewer slots and the spacing between the slots may be adjusted.

The blade support 100 has a body 102 extending from an end 104 hinged to the rim 90 at a pivot joint 106. The pivot joint 106 includes a cylindrical pivot pin 108 that extends through, and is positioned in, the rim 90 and the end 104. It

will be appreciated that in other embodiments the pivot pin 108 may be formed as part of the blade support 100. As shown in FIGS. 4 and 6, the blade support 100 pivots relative to the rim 90 about an axis 112 defined by the pivot joint 106 between an engaged position and a disengaged position.

When the blade support 100 is in the engaged position (see FIGS. 2 and 3), one of the flanges 70 of the blade assembly 36 is received in a corresponding slot 76. In the engaged position, the body 102 is fully positioned in an opening 110 formed in the rim 90. When the blade support 100 is pivoted to the disengaged position, the body 102 extends outwardly from the opening 110, as shown in FIG. 6. In the disengaged position, the slots 76 are spaced apart from the flanges 70 of the blade assembly 36.

The rotating disk 34 includes a locking device 114 that secures the blade support 100 in the engaged position. In the illustrative embodiment, the locking device 114 includes a rectangular tab 116 extending from an end 118 of the body 102. When the blade support 100 is in the engaged position, the tab 116 is received in a recess 120 formed in the rim 90. Another recess 122 formed in the end 118 of the body 102 permits a user to apply sufficient force to release the blade support 100. It will be appreciated that in other embodiments the locking device 114 may take the form of a latch, pin, or other mechanism configured to maintain the blade support 100 in the engaged position.

As discussed above, the rotating disk 34 is movable upwardly and downwardly between a plurality of cutting positions relative to the cutting blade 18. As shown in FIG. 2, in one cutting position of the rotating disk 34, the outer edge 72 of the cutting blade 18 is received in the upper slot 124 of the blade support 100. In another cutting position, the lip 74 of the mounting arm 62 is received in the upper slot 124 of the blade support 100. In other cutting positions, the lip 74 may be positioned in any of the other slots 76 of the blade support 100. It will be appreciated that in other embodiments both flanges 70 of the blade assembly 36 may be received in slots 76 of the rotating disk 34. Additionally, in other embodiments, the blade assembly 36 may include only a single flange 70, such as, for example, the outer edge 72 of the cutting blade, which is received in a slot 76 at each of the cutting positions. In addition to providing support to the cutting blade 18, the engagement of one of the flanges 70 with one of the slots 76 inhibits or prevents the upward and downward movement of the rotating disk 34 when the blade support 100 is in the engaged position.

As shown in FIGS. 2 and 3, the food slicer assembly 32 includes a separate locking mechanism 130 positioned below the lower surface 84 of the rotating disk 34 that is configured to prevent the upward and downward movement of the rotating disk 34. In that way, the rotating disk 34 can be locked at one cutting position relative to the cutting blade 18. In the illustrative embodiment, the locking mechanism 130 is also configured to prevent the blade assembly 36 from rotating relative to the rotating disk 34.

As shown in FIGS. 2 and 3, the locking mechanism 130 includes a user-operated pin 132. The term "user-operated pin" as used herein refers to a pin that is manually operated by the user without the use of a tool. This is distinct from, and in contrast to, a set screw, hex bolt, or other fastener that is operated by the user through the use of a wrench, screw driver, or other tool. The user-operated pin 132 includes an elongated shaft 134 extending from an end 136 positioned outside of the sleeve 82 to an end 138 positioned in an aperture 140 defined in the central shaft 46. A button-head 142 sized to receive a finger of a user is formed at the end

136 of the shaft 134. The outer surface 144 of the shaft 134 includes a smooth section 146 and another section having a plurality of teeth 148 extending therefrom.

The shaft 134 of the user-operated pin 132 extends through a vertically-extending slot 150 defined in the side-wall 94 of the sleeve 82. The sidewall 94 includes a plurality of teeth 152 that extend into the slot 150. As indicated by arrow 154 in FIG. 2, the shaft 134 is movable between a locked position, in which the teeth 148 of the shaft 134 interdigitate or engage with a number of the teeth 152 of the sidewall 94, and an unlocked position, in which the teeth 148 of the user-operated pin are spaced apart from the teeth 152 of the sleeve. In the locked position, the rotating disk 34 is prevented from moving upward and downward relative to the cutting blade 18. It will be appreciated that in other embodiments the central shaft 46 may have a number of teeth configured to engage with the teeth 148 of the user-operated pin 132. It will also be appreciated that in other embodiments the user-operated pin 132, central shaft 46, and sleeve 82 may have any combination of slots, grooves, flanges, or other structures suitable for locking the rotating disk 34 in position relative to the cutting blade 18.

As shown in FIGS. 2 and 3, the aperture 140 defined in the central shaft 46 extends inwardly to a bottom 160. A cylindrical guide pin 162 is positioned in an opening 164 formed at the bottom 160 of the aperture 140 and extends away from the bottom 160 to an end. A spring 168 extends over the guide pin 162 is coupled at a spring end 170 to the end 138 of the user-operated pin 132. It will be appreciated that in other embodiments the guide pin 162 may take the form of a cross, hexagon, or other shape to provide guidance and stability to the spring 168. The spring 168 biases the user-operated pin 132 away from the bottom 160 of the aperture 140 thereby engaging the teeth 148 of the user-operated pin with the teeth 152 of the sleeve.

To change the distance D between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34, the user unlocks the blade support 100 from the rim 90 and pivots the blade support 100 about the axis 112 from the engaged position to the disengaged position. The user then presses the button-head 142 to depress the user-operated pin 132. The spring 168 is compressed and the teeth 148 are moved out of contact with the teeth 152 of the sleeve 82. When the teeth 148 of the user-operated pin are spaced apart from the teeth 152 of the sleeve, the user may slide the rotating disk 34 upwardly or downwardly to another cutting position.

Once the rotating disk 34 is at the desired cutting position, the user releases the button-head 142, and the spring 168 urges the user-operated pin 132 away from the bottom 160 of the aperture 140, thereby reengaging the teeth 148 with the teeth 152 and locking the rotating disk 34 into the desired cutting position. The user pivots the blade support 100 from the disengaged position back to the engaged position, thereby preventing substantial deflection of the cutting blade 18 and providing an additional locking feature to prevent the upward/downward movement of the rotating disk 34 relative to the cutting blade 18.

It will be appreciated that in other embodiments the slicer assembly 32 may not include the blade support 100. In such embodiments, changing the distance D between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34 would involve operating only the user-operated pin 132 of the locking mechanism 130. Similarly, in other embodiments including the blade support 100, the locking mechanism 130 may be omitted and replaced with a different thickness adjustment assembly operable by

a user to vary the cutting thickness of the food processor 10. In those embodiments, changing the distance D between the cutting edge 42 of the cutting blade 18 and the upper surface 44 of the rotating disk 34 would involve, first, moving the blade support 100 to the disengaged position, which would release the rotating disk 34 for upward and downward movement, and, second, operating the thickness adjustment assembly.

Referring now to FIGS. 7 and 8, another embodiment of a food slicer assembly is shown in a food processor. Many of the components of the food processor of FIGS. 7 and 8 are common with the components of the food processor of FIGS. 1-6. Such common components have common reference numerals. The food processor of FIGS. 7 and 8 is essentially the same as the food processor of FIGS. 1-6 except that the food slicer assembly (hereinafter food slicer assembly 200) includes a different locking mechanism to prevent the upward and downward movement rotating disk 34 relative to the cutting blade 18.

The slicer assembly 200, like the slicer assembly 32 described above in reference to FIGS. 1-6, includes a blade assembly 36 and a rotating disk 34. In addition to the cutting blade 18, the blade assembly 36 includes a central shaft 202 extending from an upper end 204 to a lower end 206. The lower end 206 receives the drive stem 30, thereby coupling the slicer assembly 200 to the motor 14. As shown in FIGS. 7 and 8, one section 208 of central shaft 202 has a plurality of teeth 210 extending outwardly from an outer surface 212 thereof.

The rotating disk 34 includes a central sleeve 214 extending downwardly from a lower surface 84 thereof. A passageway 216 extends through the sleeve 214 and receives the central shaft 202 of the blade assembly 36. Similar to the locking mechanism 130 described above in reference to FIGS. 1-6, a pair of locking mechanisms 230 are positioned below the lower surface 84 of the rotating disk 34.

Each locking mechanism 230 includes a user-operated pin 232 and a lever 234 coupled thereto. The user-operated pin 232 includes a shaft 236 that is positioned in a through-hole 238 formed in a sidewall 240 of the sleeve 214. The shaft 236 extends from an end 242 positioned outside of the sleeve 214 to an end 244 positioned in the passageway 216. The user-operated pin 232 moves back and forth within the through-hole 238, as indicated by arrow 246, between a locked position and an unlocked position.

The lever 234 is positioned within the passageway 216 and is pivotably coupled to the sidewall 240 of the sleeve 214. The lever 234 has a lever body 250 that extends from an upper end 252 to a lower end 254. The upper end 252 of lever body 250 includes a tip 256 that is sized to engage with the teeth 210 formed on the central shaft 202. The lower end 254 is coupled to the end 244 of the user-operated pin 232. As shown in FIGS. 7 and 8, the ends 244, 254 are in contact but are not fixed to each other. It will be appreciated that in other embodiments the ends 244, 254 may be pivotably fastened together.

The lever body 250 is pivotably coupled to the sidewall 240 at a pivot joint 260. The pivot joint 260 includes a cylindrical pivot pin 262 that extends through lever body 250 and the sidewall 240. The lever body 250 pivots about an axis defined by the pivot joint 260 between an engaged position and a disengaged position. In the engaged position, the tip 256 of the lever 234 is engaged with a number of the teeth 210 of the central shaft 202. When the lever 234 is in the engaged position, the rotating disk 34 is prevented from moving relative to the cutting blade 18. In the disengaged position, the tip 256 of the lever is spaced apart from the

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teeth **210** of the central shaft **202** such that the lever **234** does not prevent the rotating disk **34** from being moved to another cutting position.

A spring **266** is positioned in the passageway **216** of the sleeve **214** and is coupled to the upper end **252** of the lever body **250**. The spring **266** extends from a spring end **268** coupled to the lever body **250** to a spring end **270** coupled to the sidewall **240** of the sleeve **214**. The spring **266** biases the upper end **252** of the lever **234** toward the central shaft **202** thereby engaging the tip **256** with the teeth **210** of the central shaft **202**.

When the user depresses the user-operated pin **232** of each locking mechanism **230**, the user-operated pin **232** is moved from the locked position to the unlocked position. The shaft **236** of the user-operated pin **232** acts on the lower end **254** of the lever **234**, thereby causing the lever **234** to pivot from the engaged position to the disengaged position. As the upper end **252** moves away from the central shaft **202**, the spring **266** is compressed. Thus, when the user-operated pin **232** is in the unlocked position, the lever **234** is in the disengaged position.

When the user releases the user-operated pin **232**, the spring **266** urges the upper end **252** toward the central shaft **202** thereby re-engaging the tip **256** with the teeth **210**. As the lever **234** moves back to the engaged position, the lever body **250** urges the user-operated pin **232** back to the locked position.

While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such an illustration and description is to be considered as exemplary and not restrictive in character, it being understood that only illustrative embodiments have been shown and described and that all changes and modifications that come within the spirit of the disclosure are desired to be protected.

For example, while food processor **10** is herein illustrated as a conventional domestic food processor, the features and aspects disclosed herein can also be implemented in other types of food processing devices such as automatic food slicers, dicers, ice shavers and the like. Similarly, the blade support could be removable from the rotating disk **34** instead of being pivotably coupled to the rim. Additionally, the rotating disk could be directly coupled to the motor, and the blade could be movable relative to the rotating disk.

Referring to FIGS. **9-14**, a food processor **310** is shown. One example of a food processor is the KitchenAid® 12-Cup Ultra Wide Mouth™ Food Processor, Base Model No. KFPW760OB, which is commercially available from Whirlpool Corporation of Benton Harbor, Mich., U.S.A. The food processor **310** has a base **312** that houses a motor **314** (shown schematically in FIG. **10**) and a control unit (not shown). Under the control of the control unit, the motor's output shaft **316** drives a cutting blade **318** (see FIG. **10**) to cut food items such as cheeses, meats, fruits, and vegetables. The base **312** also includes one or more buttons, switches, dials, or other types of controls **320**. A user operates the controls **320** to control the operation of the motor **314** and hence the food processor **310**. For instance, one of the controls **320** may be operable to turn the motor **314** on and off, while another control **320** may change the motor's speed.

As will be understood by those skilled in the art, the control unit may comprise analog and/or digital circuitry to process electrical signals received from the motor **314** (or other components of the food processor **310**) and provide electrical control signals to the motor or other components of the food processor **310**. For example, the control unit may

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be embodied as a microcontroller that executes firmware routines to control the operation of the food processor **310**.

A removable bowl **322** is secured to the base **312**. The bowl's handle facilitates placement of the bowl **322** on the base **312**. The bowl **322** includes a removable lid **326** secured to its upper peripheral edge. The lid **326** has a feed tube **328** formed thereon through which food items such as cheeses, meats, fruits, and vegetables are inserted into the bowl **322** to be processed by the food processor **310**. Collectively, the lid **326** and the bowl **322** define a processing chamber **324** where food items are processed by the cutting blade **318**.

The bowl **322**, lid **326**, and feed tube **328** are generally made of a transparent or translucent plastic material, so that the contents of the food processor **310** can be viewed by a user without removing the lid **326** from the bowl **322**. Moreover, one or more locking mechanisms may be used to lock the bowl to the base **312** and the lid **326** to the bowl **322**.

As shown in FIGS. **10** and **11**, when the removable bowl **322** is secured to the base **312**, the output shaft **316** of the motor **314** is coupled to a drive stem **330**. The drive stem **330** is in turn coupled to a food slicer assembly **332**. As shown in FIGS. **10-12**, the food slicer assembly **332** includes a rotating disk **334** and a blade assembly **336**, with the cutting blade **318** being one component thereof. The rotating disk **334** effectively divides the processing chamber **324** into an upper compartment **338** located between the disk **334** and the lid **326**, and a lower compartment **340** located below the rotating disk **334**. A vertical distance, *D*, between the cutting edge **342** of the cutting blade **318** and the upper surface **344** of the rotating disk **334** defines a cutting thickness. In other words, the thickness of the pieces of food items cut by the food processor **310** is determined by the distance *D* between the cutting edge **342** of the cutting blade **318** and the upper surface **344** of the rotating disk **334**. When the distance *D* between the cutting edge **342** of the cutting blade **318** and the upper surface **344** of the rotating disk **334** is increased, thicker pieces of food items are created, with thinner pieces of food items being created when the distance *D* between the cutting edge **342** of the cutting blade **318** and the upper surface **344** of the rotating disk **334** is decreased. As will be discussed in greater detail below, the rotating disk **334** is movable upwardly or downwardly between a plurality of cutting positions relative to the cutting blade **318** to vary the cutting thickness of the food processor **310**, thereby creating thicker or thinner pieces of cut food items.

As shown in FIGS. **10-13**, the blade assembly **336** includes a central shaft **346** that extends from a lower end **348** to an upper end **350**. The lower end **348** receives the drive stem **330**, thereby coupling the slicer assembly **332** to the output shaft **316** such that the slicer assembly **332** may be driven by the motor **314**. The blade assembly **336** also includes a hub **352** positioned at the upper end **350** of the central shaft **346**. As shown in FIG. **10**, a tip **354** of the hub **352** is received in a guide sleeve **356** extending downward from the underside of the lid **326**.

An inner edge **358** of the cutting blade **318** is received in a slot **360** formed between the hub **352** and the upper end **350** of the central shaft **346**. As shown in FIGS. **10** and **11**, the cutting blade **318** is secured within the slot **360** such that substantial deflection of the cutting blade **318** is inhibited when the cutting blade **318** cuts food items in the processing chamber **324**. The cutting blade **318** is also secured to a mounting arm **362** extending away from the upper end **350** of the central shaft **346** to an end **364**. A number of fasteners **366** (i.e., screws) (FIG. **12**) positioned at a rear edge **368** of the cutting blade **318** extend into the mounting arm **362**,

thereby rigidly securing the cutting blade 318 to the mounting arm 362. It will be appreciated that in other embodiments the fasteners 366 may take the form of T-stakes, pins, posts, or other structures capable of securing the cutting blade 18 to the mounting arm 362. Additionally, the mounting arm 362 may include an overmold that receives the cutting blade 318.

As shown in FIGS. 10 and 11, the blade assembly 336 also includes a pair of flanges 370 extending beyond the end 364 of the mounting arm 362. One of the flanges 370 is an outer edge 372 of the cutting blade 318. Another flange 370 is an arcuate-shaped lip 374 extending outwardly from the end 364 of the mounting arm 362 that is parallel to the outer edge 372 of the cutting blade 318. As will be discussed in greater detail below, at least one of the flanges 370 is received in one of a plurality of slots 376 formed in the rotating disk 334 at each of the cutting positions.

The rotating disk 334 includes a planar body 380 and a central sleeve 382 extending downwardly from a lower surface 384 thereof. It will be appreciated that one or more of the components of the rotating disk 334 may be formed from plastic or a metallic material. The rotating disk 334 includes a passageway 386 that extends through the sleeve 382 and receives the central shaft 346 of the blade assembly 336. The planar body 380 also has a contoured opening 388 extending from the upper surface 344 to the lower surface 384. The contoured opening 388 is sized to receive the mounting arm 362 of the blade assembly 336. When the blade assembly 336 is positioned in the rotating disk 334, a gap or throat 392 is defined between the cutting edge 342 and the body 380, as shown in FIG. 12.

During operation, the motor 314 causes the blade assembly 336 to rotate. The blade assembly 336 acts on a sidewall 394 of the sleeve 382 such that the rotating disk 334 and the blade assembly 336 rotate together. Food items inserted through the feed tube 328 are urged into contact with the upper surface 344 of the rotating disk 334 while being acted upon (i.e., cut) by the cutting blade 318. Cut food items, along with other food items small enough to fit within the throat 392, pass from the upper compartment 338 into the lower compartment 340 through the throat 392.

As best seen in FIG. 13, the mounting arm 362 has a ramp 395 defined therein, which guides food items from the throat 392 into the lower compartment 340 of the bowl 322. The surface 396 of the ramp 395 is sloped downward from an upper end 397 positioned adjacent to the cutting edge 342 to a lower end 398. As shown in FIGS. 10 and 11, the surface 396 extends radially outward from the central shaft 346 to the end 364 of the mounting arm 362. The angle of inclination or slope of the surface 396 changes along the radially length of the surface 396, increasing from approximately 15 degrees at the end 364 to approximately 25 degrees near the central shaft 346. As shown in FIG. 13, the surface 396 has an angle of inclination  $\alpha$  of approximately 22 degrees. In other embodiments, the surface 396 may be convex or concave in one or more directions. The central shaft 346 and the end 364 of the mounting arm 362 act as sidewalls for the surface 396 such that food items entering the throat 392 are guided down the ramp 395. In that way, the surface 396 is encapsulated or captured, thereby reducing the potential for food items to travel outside of the processing path and thus reducing unwanted debris.

A rim 390 extends upwardly from the outer perimeter of the disk's planar body 380. The rotating disk 334 has a diameter that is slightly less than the inner diameter of the bowl 322 such that the rim 390 is positioned adjacent to, but spaced slightly apart from, the inner wall of the bowl to

permit rotation of the disk 334 within the bowl 322. The rotating disk 334 also includes a blade support 400 pivotably coupled to the rim 90.

As best seen in FIG. 14, the blade support 400 has the plurality of slots 376 formed therein. Each of the slots 376 extends parallel to the outer edge 372 of the cutting blade 318, and each of the slots 376 is sized to receive one of the flanges 370. In the illustrative embodiment, five slots 376 are formed in the blade support 400, and the slots 376 are spaced apart from each other by two millimeters. It will be appreciated that in other embodiments the blade support 400 may include additional or fewer slots and the spacing between the slots may be adjusted.

The blade support 400 has a body 402 extending from an end 404 hinged to the rim 390 at a pivot joint 406. The pivot joint 406 includes a cylindrical pivot pin 408 that extends through, and is positioned in, the rim 390 and the end 404. It will be appreciated that in other embodiments the pivot pin 408 may be formed as part of the blade support 400. As shown in FIGS. 12 and 14, the blade support 400 pivots relative to the rim 390 about an axis 412 defined by the pivot joint 406 between an engaged position and a disengaged position.

When the blade support 400 is in the engaged position (see FIGS. 10 and 11), one of the flanges 370 of the blade assembly 336 is received in a corresponding slot 376. In the engaged position, the body 402 is fully positioned in an opening 410 formed in the rim 390. When the blade support 400 is pivoted to the disengaged position, the body 402 extends outwardly from the opening 410, as shown in FIG. 14. In the disengaged position, the slots 376 are spaced apart from the flanges 370 of the blade assembly 336.

The rotating disk 334 includes a locking device 414 that secures the blade support 400 in the engaged position. In the illustrative embodiment, the locking device 414 includes a rectangular tab 416 extending from an end 418 of the body 402. When the blade support 400 is in the engaged position, the tab 416 is received in a recess 420 formed in the rim 390. Another recess 422 formed in the end 418 of the body 402 permits a user to apply sufficient force to release the blade support 400. It will be appreciated that in other embodiments the locking device 414 may take the form of a latch, pin, or other mechanism configured to maintain the blade support 400 in the engaged position.

As discussed above, the rotating disk 334 is movable upwardly and downwardly between a plurality of cutting positions relative to the cutting blade 318. As shown in FIG. 10, in one cutting position of the rotating disk 334, the outer edge 372 of the cutting blade 318 is received in the upper slot 424 of the blade support 400. In another cutting position, the lip 374 of the mounting arm 362 is received in the upper slot 424 of the blade support 400. In other cutting positions, the lip 374 may be positioned in any of the other slots 376 of the blade support 400. It will be appreciated that in other embodiments both flanges 370 of the blade assembly 336 may be received in slots 376 of the rotating disk 334. Additionally, in other embodiments, the blade assembly 336 may include only a single flange 370, such as, for example, the outer edge 372 of the cutting blade, which is received in a slot 376 at each of the cutting positions. In addition to providing support to the cutting blade 318, the engagement of one of the flanges 370 with one of the slots 376 inhibits or prevents the upward and downward movement of the rotating disk 334 when the blade support 400 is in the engaged position.

As shown in FIGS. 10 and 11, the food slicer assembly 332 includes a separate locking mechanism 430 positioned

below the lower surface **384** of the rotating disk **334** that is configured to prevent the upward and downward movement of the rotating disk **334**. In that way, the rotating disk **334** can be locked at one cutting position relative to the cutting blade **318**. In the illustrative embodiment, the locking mechanism **430** is also configured to prevent the blade assembly **336** from rotating relative to the rotating disk **334**.

As shown in FIGS. **10** and **11**, the locking mechanism **430** includes a user-operated pin **432**. The term “user-operated pin” as used herein refers to a pin that is manually operated by the user without the use of a tool. This is distinct from, and in contrast to, a set screw, hex bolt, or other fastener that is operated by the user through the use of a wrench, screw driver, or other tool. The user-operated pin **432** includes an elongated shaft **434** extending from an end **436** positioned outside of the sleeve **382** to an end **438** positioned in an aperture **440** defined in the central shaft **346**. A button-head **442** sized to receive a finger of a user is formed at the end **436** of the shaft **434**. The outer surface **444** of the shaft **434** includes a smooth section **446** and another section having a plurality of teeth **448** extending therefrom.

The shaft **434** of the user-operated pin **432** extends through a vertically-extending slot **450** defined in the sidewall **394** of the sleeve **382**. The sidewall **394** includes a plurality of teeth **452** that extend into the slot **450**. As indicated by arrow **454** in FIG. **10**, the shaft **434** is movable between a locked position, in which the teeth **448** of the shaft **434** interdigitate or engage with a number of the teeth **452** of the sidewall **394**, and an unlocked position, in which the teeth **448** of the user-operated pin are spaced apart from the teeth **452** of the sleeve. In the locked position, the rotating disk **334** is prevented from moving upward and downward relative to the cutting blade **318**. It will be appreciated that in other embodiments the central shaft **346** may have a number of teeth configured to engage with the teeth **448** of the user-operated pin **432**. It will also be appreciated that in other embodiments the user-operated pin **432**, central shaft **346**, and sleeve **382** may have any combination of slots, grooves, flanges, or other structures suitable for locking the rotating disk **334** in position relative to the cutting blade **318**.

As shown in FIGS. **10** and **11**, the aperture **440** defined in the central shaft **346** extends inwardly to a bottom **460**. A cylindrical guide pin **462** is positioned in an opening **464** formed at the bottom **460** of the aperture **440** and extends away from the bottom **460** to an end. A spring **368** extends over the guide pin **462** and is coupled at a spring end **470** to the end **438** of the user-operated pin **432**. It will be appreciated that in other embodiments the guide pin **462** may take the form of a cross, hexagon, or other shape to provide guidance and stability to the spring **468**. The spring **468** biases the user-operated pin **432** away from the bottom **460** of the aperture **440** thereby engaging the teeth **448** of the user-operated pin with the teeth **452** of the sleeve.

To change the distance **D** between the cutting edge **442** of the cutting blade **418** and the upper surface **344** of the rotating disk **334**, the user unlocks the blade support **400** from the rim **390** and pivots the blade support **400** about the axis **412** from the engaged position to the disengaged position. The user then presses the button-head **442** to depress the user-operated pin **432**. The spring **468** is compressed and the teeth **448** are moved out of contact with the teeth **452** of the sleeve **382**. When the teeth **448** of the user-operated pin are spaced apart from the teeth **452** of the sleeve, the user may slide the rotating disk **334** upwardly or downwardly to another cutting position.

Once the rotating disk **334** is at the desired cutting position, the user releases the button-head **442**, and the

spring **468** urges the user-operated pin **432** away from the bottom **460** of the aperture **440**, thereby reengaging the teeth **448** with the teeth **452** and locking the rotating disk **334** into the desired cutting position. The user pivots the blade support **400** from the disengaged position back to the engaged position, thereby preventing substantial deflection of the cutting blade **318** and providing an additional locking feature to prevent the upward/downward movement of the rotating disk **334** relative to the cutting blade **318**.

It will be appreciated that in other embodiments the slicer assembly **332** may not include the blade support **400**. In such embodiments, changing the distance **D** between the cutting edge **342** of the cutting blade **318** and the upper surface **344** of the rotating disk **334** would involve operating only the user-operated pin **432** of the locking mechanism **430**. Similarly, in other embodiments including the blade support **400**, the locking mechanism **430** may be omitted and replaced with a different thickness adjustment assembly operable by a user to vary the cutting thickness of the food processor **310**. In those embodiments, changing the distance **D** between the cutting edge **342** of the cutting blade **318** and the upper surface **344** of the rotating disk **334** would involve, first, moving the blade support **400** to the disengaged position, which would release the rotating disk **334** for upward and downward movement, and, second, operating the thickness adjustment assembly.

Referring now to FIGS. **15** and **16** another embodiment of a food slicer assembly is shown in a food processor. Many of the components of the food processor of FIGS. **15** and **16** are common with the components of the food processor of FIGS. **9-14**. Such common components have common reference numerals. The food processor of FIGS. **15** and **16** is essentially the same as the food processor of FIGS. **9-14** except that the food slicer assembly (hereinafter food slicer assembly **500**) includes a different locking mechanism to prevent the upward and downward movement rotating disk **334** relative to the cutting blade **318**.

The slicer assembly **500**, like the slicer assembly **332** described above in reference to FIGS. **9-14**, includes a blade assembly **336** and a rotating disk **334**. In addition to the cutting blade **318**, the blade assembly **336** includes a central shaft **502** extending from an upper end **504** to a lower end **506**. The lower end **506** receives the drive stem **330**, thereby coupling the slicer assembly **500** to the motor **314**. As shown in FIGS. **15** and **16**, one section **508** of central shaft **502** has a plurality of teeth **510** extending outwardly from an outer surface **512** thereof.

The rotating disk **334** includes a central sleeve **514** extending downwardly from a lower surface **384** thereof. A passageway **516** extends through the sleeve **514** and receives the central shaft **502** of the blade assembly **336**. Similar to the locking mechanism **430** described above in reference to FIGS. **9-14**, a pair of locking mechanisms **530** are positioned below the lower surface **384** of the rotating disk **334**.

Each locking mechanism **530** includes a user-operated pin **532** and a lever **534** coupled thereto. The user-operated pin **532** includes a shaft **536** that is positioned in a through-hole **538** formed in a sidewall **540** of the sleeve **514**. The shaft **536** extends from an end **542** positioned outside of the sleeve **514** to an end **544** positioned in the passageway **516**. The user-operated pin **532** moves back and forth within the through-hole **538**, as indicated by arrow **546**, between a locked position and an unlocked position.

The lever **534** is positioned within the passageway **516** and is pivotably coupled to the sidewall **541** of the sleeve **514**. The lever **534** has a lever body **550** that extends from an upper end **552** to a lower end **554**. The upper end **552** of



lever body 550 includes a tip 556 that is sized to engage with the teeth 510 formed on the central shaft 502. The lower end 554 is coupled to the end 544 of the user-operated pin 532. As shown in FIGS. 15 and 16, the ends 544, 554 are in contact but are not fixed to each other. It will be appreciated that in other embodiments the ends 544, 554 may be pivotably fastened together.

The lever body 550 is pivotably coupled to the sidewall 540 at a pivot joint 560. The pivot joint 560 includes a cylindrical pivot pin 562 that extends through lever body 550 and the sidewall 540. The lever body 550 pivots about an axis defined by the pivot joint 560 between an engaged position and a disengaged position. In the engaged position, the tip 556 of the lever 534 is engaged with a number of the teeth 510 of the central shaft 502. When the lever 534 is in the engaged position, the rotating disk 334 is prevented from moving relative to the cutting blade 318. In the disengaged position, the tip 556 of the lever is spaced apart from the teeth 510 of the central shaft 502 such that the lever 534 does not prevent the rotating disk 334 from being moved to another cutting position.

A spring 566 is positioned in the passageway 516 of the sleeve 514 and is coupled to the upper end 552 of the lever body 550. The spring 566 extends from a spring end 568 coupled to the lever body 550 to a spring end 570 coupled to the sidewall 540 of the sleeve 514. The spring 566 biases the upper end 552 of the lever 534 toward the central shaft 502 thereby engaging the tip 556 with the teeth 510 of the central shaft 502.

When the user depresses the user-operated pin 532 of each locking mechanism 530, the user-operated pin 532 is moved from the locked position to the unlocked position. The shaft 536 of the user-operated pin 532 acts on the lower end 554 of the lever 534, thereby causing the lever 534 to pivot from the engaged position to the disengaged position. As the upper end 552 moves away from the central shaft 502, the spring 566 is compressed. Thus, when the user-operated pin 532 is in the unlocked position, the lever 534 is in the disengaged position.

When the user releases the user-operated pin 532, the spring 566 urges the upper end 552 toward the central shaft 502 thereby re-engaging the tip 556 with the teeth 510. As the lever 534 moves back to the engaged position, the lever body 550 urges the user-operated pin 532 back to the locked position.

While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such an illustration and description is to be considered as exemplary and not restrictive in character, it being understood that only illustrative embodiments have been shown and described and that all changes and modifications that come within the spirit of the disclosure are desired to be protected.

For example, while food processor 310 is herein illustrated as a conventional domestic food processor, the features and aspects disclosed herein can also be implemented in other types of food processing devices such as automatic food slicers, dicers, ice shavers and the like. Similarly, the blade support could be removable from the rotating disk 334 instead of being pivotably coupled to the rim. Additionally, the rotating disk could be directly coupled to the motor, and the blade could be movable relative to the rotating disk.

Referring to FIG. 17, a food processing device or food processor 610 is shown. One example of a food processor is the KitchenAid® 12-Cup Ultra Wide Mouth™ Food Processor, Base Model No. KFPW7600B, which is commercially available from Whirlpool Corporation of Benton Harbor, Mich., U.S.A. The food processor 610 has a base

612 that houses a motor 614 (shown schematically in FIG. 18) and a control unit (not shown). Under the control of the control unit, the motor's output shaft 616 drives a cutting blade 618 (see FIG. 18) to cut food items such as cheeses, meats, fruits, and vegetables. The base 612 also includes one or more buttons, switches, dials, or other types of controls 620. A user operates the controls 620 to control the operation of the motor 614 and hence the food processor 610. For instance, one of the controls 620 may be operable to turn the motor 614 on and off, while another control 620 may change the motor's speed.

As will be understood by those skilled in the art, the control unit may comprise analog and/or digital circuitry to process electrical signals received from the motor 614 (or other components of the food processor 610) and provide electrical control signals to the motor or other components of the food processor 610. For example, the control unit may be embodied as a microcontroller that executes firmware routines to control the operation of the food processor 610.

A removable bowl 622 is secured to the base 612. The bowl's handle facilitates placement of the bowl 622 on the base 612. The bowl 622 includes a removable lid 626 secured to its upper peripheral edge. The lid 626 has a feed tube 628 formed thereon through which food items such as fruits and vegetables are inserted into the bowl 622 to be processed by the food processor 610. Collectively, the lid 626 and the bowl 622 define a processing chamber 624 where food items are processed by the cutting blade 618.

The bowl 622, lid 626, and feed tube 628 are generally made of a transparent or translucent plastic material, so that the contents of the food processor 610 can be viewed by a user without removing the lid 626 from the bowl 622. Moreover, one or more locking mechanisms may be used to lock the bowl to the base 612 and the lid 626 to the bowl 622.

As shown in FIGS. 18 and 19, when the removable bowl 622 is secured to the base 612, the output shaft 616 of the motor 614 is coupled to a drive stem 630. The drive stem 630 is in turn coupled to a food slicer assembly 632. As shown in FIGS. 18-20, the food slicer assembly 632 includes a rotating disk 634, a thickness adjustment assembly 636, and a blade assembly 638, with the cutting blade 618 being one component thereof. The rotating disk 634 effectively divides the processing chamber 624 into an upper compartment 640 located between the disk 634 and the lid 626, and a lower compartment 642 located below the rotating disk 634. A vertical distance, D, between the cutting edge 644 of the cutting blade 618 and the upper surface 646 of the rotating disk 634 defines a cutting thickness. In other words, the thickness of the pieces of food items cut by the food processor 610 is determined by the distance D between the cutting edge 644 of the cutting blade 618 and the upper surface 646 of the rotating disk 634. When the distance D between the cutting edge 644 of the cutting blade 618 and the upper surface 646 of the rotating disk 634 is increased, thicker pieces of food items are created, with thinner pieces of food items being created when the distance D between the cutting edge 644 of the cutting blade 618 and the upper surface 646 of the rotating disk 634 is decreased.

The rotating disk 634 includes a planar body 652 and a rim 654 that extends upwardly from the outer perimeter of the planar body 652. The rotating disk 634 has a diameter that is slightly less than the inner diameter of the bowl 622 such that the rim 654 is positioned adjacent to, but spaced slightly apart from, the inner wall of the bowl to permit rotation of the disk 634 within the bowl 622. In the exemplary embodiment described herein, the rotating disk 634 is embodied as a monolithic structure (e.g., a single molded or

cast part). However, it should be appreciated that the components of the rotating disk 634 (e.g., body 652 and rim 654) may be embodied as separate components secured to one another by an adhesive or other suitable fastener.

The thickness adjustment assembly 636 is operable by a user to vary the cutting thickness of the food processor 610 thereby creating thicker or thinner pieces of cut food items. The adjustment assembly 636 includes a hub 660 and a user-operated control device 662. The hub 660 includes a base 664 and a hollow sleeve 666 extending upwardly therefrom. A number of fasteners 668 (i.e., screws) extend through the planar body 652 into the base 664, thereby rigidly securing the rotating disk 634 to the hub 660. It will be appreciated that in other embodiments the hub 660 and the rotating disk 634 may be integrally formed as a monolithic structure. As shown in FIGS. 18 and 19, the sleeve 666 extends through an opening 669 formed in the planar body 652. External threads 670 are defined on a portion of an outer surface 672 of the sleeve 666.

The user-operated control device 662 is positioned above the upper surface 646 of the rotating disk 634. As shown in FIGS. 18-20, the user-operated control device 662 includes a control knob 674. The control knob 674 has a body 676 that extends from a lower end 678 to an upper end 680. The body 676 includes a knurled grip 682 formed in the upper end 680 and an annular flange 684 extending outwardly from the lower end 678. It should be appreciated that other user-activated control devices, such as levers, dials, buttons, or the like, may be substituted for the control knob.

As shown in FIGS. 18 and 19, the body 676 of the control knob 674 has an aperture 686 formed in the lower end 678 that receives the sleeve 666 of the hub 660. The inner surface 688 of the aperture 686 has internal threads 690 defined therein that correspond to the external threads 670 of the hub 660. The internal threads 690 of the control knob 674 threadingly engage the external threads 670 of the hub 660 to move the hub 660 (and hence the rotating disk 634) upwardly and downwardly relative to the cutting blade 618. For example, clockwise rotation of the control knob 674 causes upward movement of the hub 660 (and hence the rotating disk 634), while counter-clockwise rotation of the control knob 674 causes downward movement of the hub 660 (and hence the rotating disk 634).

As shown in FIGS. 18 and 19, a central shaft 698 of the blade assembly 638 is received in the hollow sleeve 666 of the adjustment assembly 636 and is secured at an upper end 702 to the control knob 674. The central shaft 698 extends from the upper end 702 to a lower end 704, which has an opening 706 that receives the drive stem 630. In that way, the slicer assembly 632 is coupled to the output shaft 616 such that the slicer assembly 632 may be driven by the motor 614. The blade assembly 638 also includes a mounting arm 710 extending from an inner end 712, which is secured to the lower end 704 of the central shaft 698, to an outer end 714, which is positioned adjacent to the rim 654 of the rotating disk 634. In the illustrative embodiment, the central shaft 698 and mounting arm 710 are formed as a single monolithic component from a plastic or metallic material. It should be appreciated that in other embodiments the shaft 698 and arm 710 may be formed as separate components that are joined during final assembly by an adhesive or other suitable fastener.

The cutting blade 618 is secured to an upper surface 716 of the mounting arm 710. A number of fasteners 720 (i.e., screws) positioned at a rear edge 722 of the cutting blade 618 extend into the mounting arm 710, thereby rigidly securing the cutting blade 618 to the mounting arm 710. It

will be appreciated that in other embodiments the fasteners 720 may take the form of T-stakes, pins, posts, or other structures capable of securing the cutting blade 618 to the mounting arm 710. Additionally, the mounting arm 710 may include an overmold that receives the cutting blade 618.

As shown in FIG. 20, the opening 669 formed in the planar body 652 extends radially outward and receives the mounting arm 710 and the cutting blade 618. When the food slicer assembly 632 is assembled, a gap or throat 724 is defined between the cutting edge 644 and the body 652, as best seen in FIGS. 20 and 21. The food slicer assembly 632 also includes a counterweight 726 coupled to the planar body 652 adjacent to the outer perimeter of the rotating disk 634. As shown in FIGS. 18 and 19, the hub 660 is positioned between the counterweight 726 and the cutting blade 618. The counterweight 726 is sized to offset the weight of the mounting arm 710 and the cutting blade 618. In that way, the counterweight 726 balances the slicer assembly 632 as it is rotated. In other embodiments, the separate counterweight 726 may be omitted and additional material may be added to the rim 654 and the planar body 652 such that the counterweight is incorporated into the rotating disk 634.

During operation, the user may change the cutting position of the rotating disk 634 using the control knob 674. When the control knob 674 is rotated, the hub 660 translates upwardly and downwardly along the central shaft 698 to change the thickness of the food items being processed by the food processor 610. In particular, counter-clockwise rotation of the control knob 674 causes downward movement of the hub 660 (and hence rotating disk 634), which increases the distance D between the cutting edge 644 of the cutting blade 618 and the upper surface 646 of the rotating disk 634 and thereby produces thicker pieces of food items. Oppositely, when the control knob 674 is rotated clockwise, the hub 660 is moved upwardly along the central shaft 698 and the distance D between the cutting edge 644 of the cutting blade 618 and the upper surface 646 of the rotating disk 634 is decreased, thereby producing thinner pieces of food items.

When the food processor 610 is activated, the motor 614 causes the blade assembly 638 to rotate. The blade assembly 638 acts on the hub 660 secured to the rotating disk 634 such that the rotating disk 634 and the blade assembly 638 rotate together. Food items inserted through the feed tube 628 are urged into contact with the upper surface 646 of the rotating disk 634 while being acted upon (i.e., cut) by the cutting blade 618. Cut food items, along with other food items small enough to fit within the throat 724, pass from the upper compartment 640 through the throat 724.

A ramp 730 defined in the mounting arm 710 guides food items from the upper compartment 640 to the lower compartment 642. As shown in FIG. 21, the ramp 730 is positioned adjacent to and below the cutting blade 618 and includes an inclined surface 732 extending downwardly from the underside of cutting blade 618. The inclined surface 732 extends from the inner end 712 of the mounting arm 710 radially outward to the outer end 714 of the mounting arm 710. As shown in FIGS. 18 and 19, the inner end 712 defines an inner sidewall 734 for the ramp 730, while the outer end 714 of the mounting arm 710 defines an outer sidewall 736. In that way, the inclined surface 732 is encapsulated or captured between the sidewalls 734, 736, thereby reducing the potential for food items to travel outside of the processing path and thus reducing unwanted debris.

As shown in FIGS. 21 and 22, the slope or angle of the inclined surface 732 relative to the cutting blade 618

changes as the inclined surface 732 extends radially outward. As shown in FIG. 21, which is a cross-section of the slicer assembly 632 taken at the outer end 714 of the mounting arm 710, the inclined surface 732 has an angle of inclination  $\alpha$  at the outer end 714. As shown in FIG. 22, which is a cross-section of the slicer assembly 632 taken at the inner end 712 of the mounting arm 710, the inclined surface 732 has an angle of inclination  $\beta$  that is greater than the angle  $\alpha$ . In the illustrative embodiment, the angle  $\alpha$  is approximately 15 degrees, and the angle  $\beta$  is approximately 25 degrees. It will be appreciated that in other embodiments the angles  $\alpha$ ,  $\beta$  may be greater than or less than those of the illustrative embodiment. Additionally, in some embodiments, the angles  $\alpha$ ,  $\beta$  may be equal. In still other embodiments, the inclined surface 732 may be convex or concave in one or more directions.

Referring to FIG. 23, a food processing device or food processor 810 is shown. The food processor 810 has a base 812 that houses a motor 814 and a control unit. Under the control of the control unit, the motor 814 drives a cutting assembly 816 to cut food items such as cheeses, meats, fruits, and vegetables. The base 812 also includes one or more buttons, switches, dials, or other types of controls 818. A user operates the controls 818 to control the operation of the motor 814 and hence the food processor 810. For example, one of the controls 818 may be operable to turn the motor 814 on and off while another control 818 may change the motor's speed.

As will be understood by those skilled in the art, the control unit may comprise analog and/or digital circuitry to process electrical signals received from the motor 814 (or other components of the food processor 810) and provide electrical control signals to the motor or other components of the food processor 810. For example, the control unit may be embodied as a microcontroller that executes firmware routines to control the operation of the food processor 810.

A removable receptacle or bowl 820 is secured to the base 812. The bowl's handle facilitates placement of the bowl 820 on the base 812. The bowl 820 includes a removable lid 822 secured to its upper peripheral edge. The lid 822 has a feed tube 824 formed thereon through which food items such as fruits and vegetables are inserted into the bowl 820 to be processed by the food processor 810. Collectively, the lid 822 and the bowl 820 define a processing chamber 826 where food items are processed by the cutting assembly 816.

The bowl 820, lid 822, and feed tube 824 are generally made of a transparent or translucent plastic material so that the contents of the food processor 810 can be viewed by a user without removing the lid 822 from the bowl 820. Moreover, one or more locking mechanisms may be used to lock the bowl to the base 812 and the lid 822 to the bowl 820.

As shown in FIG. 23, the cutting assembly 816 includes a cutting blade 830 and a rotating disk 832, which effectively divides the processing chamber 826 into an upper compartment 834 located between the disk 832 and the lid 822, and a lower compartment 836 located underneath the disk 832. A vertical distance, D, between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 defines a cutting thickness of food items processed by the cutting assembly 816. In other words, the thickness of the pieces of food items cut by the food processor 810 is determined by the distance D between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832. As the distance D between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 increases, thicker pieces of food items are created; while thinner pieces of food items are

created when the distance D between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 decreases. The cutting assembly 816 has a number of cutting positions in which the distance D between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 is preset.

A thickness adjustment assembly 842 is operable by a user to vary the cutting thickness of the food processor 810 while the cutting assembly 816 is driven by the motor 814, thereby creating thicker or thinner pieces of cut food items during a cutting operation. The adjustment assembly 842 includes a user-operated control device 844 that is located outside of the processing chamber 826 defined by the bowl 820 and the lid 822. What is meant herein by the term "outside" as it relates to the location of the user-operated control device relative to the bowl or the processing chamber is that the structure of the control device contacted by the user to operate the device is positioned external to the bowl and lid so that it may be operated by the user while the lid is secured to the bowl, thereby allowing the cutting thickness of the food processor to be adjusted while the cutting assembly 816 is driven by the motor 814.

For example, in the illustrative embodiment described herein, the external control device 844 is embodied as a control lever 846 that extends outwardly from the base 812 and is movable relative to the base 812 to change the cutting thickness of the cutting assembly 816 without removing the lid 822 from the bowl 820. In such a configuration, the user moves the control lever 846 one direction or the other to change (i.e., increase or decrease) the distance D between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832. It should be appreciated that other user-operated control devices, such as knobs, dials, buttons, servo-motors, or the like, may be substituted for the control lever 846.

Referring now to FIGS. 24-26, the motor 14 includes an output shaft 850 extending upwardly from the base 812. The output shaft 850 is coupled to a drive stem 852, which is in turn coupled to a central shaft 854 of a blade assembly 856 of the cutting assembly 816. The central shaft 854 has a socket 858 formed in its lower end. A pair of tabs 860 extending from the upper end of the drive stem 852 is received in the socket 858, thereby coupling the drive stem 852 (and hence the output shaft 850 of the motor 814) to the central shaft 854 of the blade assembly 856. As such, rotation of the output shaft 850 causes rotation of the blade assembly 856. It should be appreciated that the position of the socket and the tabs may be reversed with the tabs being formed in the central shaft 854 and the socket being formed on the drive stem 852.

The blade assembly 856 also includes a mounting arm 862 that extends outwardly from the central shaft 854. The cutting blade 830 is secured to the upper surface of the mounting arm 862. In the exemplary embodiment, the central shaft 854 and the mounting arm 862 are formed from a metallic material as a single monolithic component. It should be appreciated that in other embodiments the shaft 854 and the arm 862 may be formed as separate components, which are then joined together during final assembly by an adhesive or other suitable fastener.

A number of fasteners 864 (i.e., screws) positioned at a rear edge 866 of the cutting blade 830 extend into the mounting arm 862, thereby rigidly securing the cutting blade 830 to the mounting arm 862. It will be appreciated that in other embodiments the fasteners 864 may take the form of T-stakes, pins, posts, or other structures capable of securing

the cutting blade **830** to the arm **862**. As best seen in FIG. **24**, the arm **862** includes an overmold **868** that receives the cutting blade **830**.

The rotating disk **832** includes a central hub **870**, a planar body **872** extending radially outward the central hub **870**, and a rim **874** extending upwardly from the outer perimeter of the planar body **872**. The rotating disk **832** has a diameter that is slightly less than the inner diameter of the bowl **820** such that the rim **874** is positioned adjacent to, but is slightly spaced apart from, the inner wall of the bowl to permit rotation of the disk **832** within the bowl **820**. In the exemplary embodiment described herein, the planar body **872** and the rim **874** are embodied as a monolithic structure (e.g., a single molded or cast part). However, it should be appreciated that all of the components of the rotating disk **832** (e.g., hub **870**, body **872**, and rim **874**) may be integrated into a single monolithic structure or may be formed as separate components secured to one another by an adhesive or other suitable fastener.

The hub **870** of the rotating disk **832** has a sidewall **876** that defines a passageway **878** extending through the hub **870**. The central shaft **854** of the blade assembly **856** is positioned in the passageway **878**. The hub **870** also has a pocket **880** defined in the sidewall **876** that opens into the passageway **878**. The mounting arm **862** of the blade assembly **856** is received in the pocket **880**, thereby torsionally securing the blade assembly **856** to the rotating disk **832**. As such, rotation of the blade assembly **856** by the output shaft **850** causes rotation of the rotating disk **832**.

The mounting arm **862** extends outwardly from the pocket **880** and is positioned in an oblong opening **882** formed in the rotating disk **832**. The rotating disk **832** is permitted to vertically slide relative to the mounting arm **862** and the blade **830**. In use, when the cutting thickness is adjusted, the rotating disk **832** slides upwardly or downwardly relative to the blade assembly **856** (e.g., cutting blade **830**). Because the blade assembly **856** is fixed to the drive stem **852**, the cutting blade **830** is maintained in its vertical position such that, as the rotating disk **832** moves upwardly or downwardly, the distance **D** defined between the cutting edge **838** of the cutting blade **830** and the upper surface **840** of the rotating disk **832** changes, thereby changing the cutting thickness. As seen in FIG. **25**, the distance **D** defined between the cutting edge **838** of the cutting blade **830** and the upper surface **840** of the rotating disk **832** is relatively small, resulting in thinner slices. Oppositely, as shown in FIG. **26**, the distance **D** defined between the cutting edge **838** of the cutting blade **830** and the upper surface **840** of the rotating disk **832** is larger because the rotating disk **832** has moved downward relative to the cutting blade **830**, which results in thicker slices.

As described above, the food processor **810** includes the thickness adjustment assembly **842**, which is operable to move the rotating disk **832** relative to the cutting blade **830**. The adjustment assembly **842** includes a two-piece adaptor **884** coupled to the hub **870** of the rotating disk **832**, a lift device **886** supporting the adaptor **884** and the rotating disk **832**, and a gear assembly **888** positioned in the base **812**. The adaptor **884** includes an upper shaft **890** secured to the hub **870** of the rotating disk **832** and a lower shaft **892** rotatably coupled to the lift device **886**. The upper shaft **890** has a cylindrical body **894** that extends from an upper end **896** to a lower end **898**. The upper end **896** of the upper shaft **890** has a pair of tabs **900** extending outwardly therefrom. Each tab **900** is positioned in a corresponding slot **902** defined in the hub **870**, thereby securing the shaft **890** to the rotating disk **832** such that rotation of the rotating disk **832**

causes rotation of the shaft **890**. At the lower end **898** of the shaft **890**, a plurality of teeth **910** are formed in the body **894** to secure the upper shaft **890** to the lower shaft **892**, as described in greater detail below.

The shaft **890** of the adaptor **884** also includes an opening **904** that is defined in the upper end **896** of the cylindrical body **894**. The body **894** includes an inner wall **906** extending downwardly from the opening **904** and defining a passageway **908** through the body **894**. When assembled, the shaft **890** is positioned over the drive stem **852** and the lower end of the central shaft **854** of the blade assembly **856** such that the stem **852** and shaft **854** are received in the passageway **908**.

The lower shaft **892** of the adaptor **884** is torsionally secured to the lower end **898** of the shaft **890** such that the rotation of the shaft **890** causes rotation of the shaft **892**. The lower shaft **892**, like the upper shaft **890**, has a cylindrical body **912** extending from an upper end **914** to a lower end **916**. The body **912** includes a plurality of teeth **918**, which are formed at the upper end **914**. When the adaptor **84** is assembled, the teeth **918** of the lower shaft **892** are interdigitated with the teeth **910** of the upper shaft **890**, thereby securing the shaft **890**, **892** together. It will be appreciated that in other embodiments a combination of pins and slots as well as other fastening means may be used to torsionally secure the shafts **890** to the shaft **892**.

As shown in FIGS. **25-26**, the shaft **890** includes a biasing mechanism **920** positioned in the passageway **908**, and the biasing mechanism **920** is configured to bias the upper shaft **890** into engagement with the lower shaft **892**. The biasing mechanism **920** includes a sleeve **922** positioned in the middle of the passageway **908**. The sleeve **922** has the drive stem **852** of the motor **814** extending therethrough.

The sleeve **922** includes an upper rim **924** that contacts the lower surface **926** of the central shaft **854** of the blade assembly **856** when the upper shaft **890** is secured to the rotating disk **832**. A flange **928** extends outwardly from the upper rim **924**. Similarly, the inner wall **906** of the upper shaft **890** includes an inner flange **930** extending inwardly into the passageway **908**. A biasing element, such as a spring **932**, is positioned between the flanges **928**, **930**. The spring **932** urges the shaft **890** downward to maintain engagement between the teeth **910**, **918** such that the shafts **890**, **892** remain coupled together.

The lift device **886** is operable to move the adaptor **884** (and hence rotating disk **832**) upwardly and downwardly relative to the base. The lift device **886** includes a screw-type drive assembly having an internally-threaded upper sleeve **940** and an externally-threaded lower sleeve **942**. The internal threads **944** of the upper sleeve **940** threadingly engage the external threads **946** of the lower sleeve **942** to move the upper sleeve **940** upwardly and downwardly relative to the base **812**. For example, counter-clockwise rotation of the upper sleeve **940** may cause downward movement of the upper sleeve **940**, while clockwise rotation of the upper sleeve **940** may cause upward movement of the upper sleeve **940**.

The lower end **916** of the shaft **892** of the adaptor **884** is rotatably coupled to the upper sleeve **940** of the lift device **886** via a bearing **948**. In that way, the shaft **892** (and hence cutting assembly **816**) is permitted to rotate relative to the upper sleeve **940**. At the same time, the bearing **948** fixes the axial position of the shaft **892** relative to the upper sleeve **940** such that upward and downward movement of the upper sleeve **940** causes upward and downward movement of the shaft **892**.

In use, the thickness of food items being processed by the food processor **810** changes as the upper sleeve **940** translates upwardly and downwardly because the adaptor **884** moves with the upper sleeve **940**. In particular, as the upper sleeve **940** moves downwardly along the lower sleeve **942**, the lower shaft **892** of the adaptor **884** moves downwardly with the upper sleeve **940**. The spring **832** within the upper shaft **890** urges the upper shaft **890** to move downwardly with the lower shaft **892**. Because the upper shaft **890** is secured to the hub **870** of the rotating disk **832**, that vertical movement of the upper shaft **890** of the adaptor **884** causes vertical movement of the rotating disk **832** relative to the cutting blade **830**. As such, when the upper sleeve **940** is moved downwardly, the rotating disk **832** is moved downwardly, and the distance **D** between the cutting edge **838** of the cutting blade **830** and the upper surface **840** of the rotating disk **832** is increased, thereby producing thicker pieces of food items. Oppositely, as the upper sleeve **940** translates upwardly along the lower sleeve **942**, the rotating disk **832** moves upwardly, and the distance **D** between the cutting edge **838** of the cutting blade **830** and the upper surface **840** of the rotating disk **832** decreases, thereby producing thinner pieces of food items.

While the lift device **886** is operable to change the vertical position of the rotating disk **832**, the lift device **886** is isolated from the rotational force of the motor **814** such that the lift device **886** is not driven along with the cutting assembly **816**. As described above, the adaptor **884**, which rotates with the cutting assembly **816**, is rotatably coupled to the upper sleeve **940** via the bearing **948**. Additionally, in the illustrative embodiment, the upper sleeve **940** has a hollow passageway **950** extending therethrough. The output shaft **850** of the motor **814** is positioned in the hollow passageway **950**, and the hollow passageway **950** is sized such that the output shaft **850** is spaced apart from the upper sleeve **940**. The output shaft **850** is rotatably coupled to the lower sleeve **942** via a pair of bearings **952** such that the output shaft **850** is permitted to rotate relative to the lower sleeve **942**. As such, rotational force from the output shaft **850** is not transmitted to the sleeves **940**, **942** of the lift device **886**.

The lower sleeve **942** is secured to the base **812** such that the sleeve **942** does not rotate. The base **812** has a compartment **960** that is defined by an outer wall **962**. A platform **964** is positioned within the compartment **960**, and the lower sleeve **942** is secured to the platform **964**. As best seen in FIG. **24**, the gear assembly **888** is also positioned within the compartment **960**. The gear assembly **888** includes a drive gear **970** and a guide gear **972** that are pivotally coupled to the platform **964**. Each of the gears **970**, **972** is an external gear having a plurality of teeth **974**, **976** defined on an outer surface **978**, **980** thereof. The teeth **974**, **976** are interdigitated such that rotation of the drive gear **970** causes rotation of the guide gear **972**.

As best seen in FIG. **27**, the guide gear **972** has a body **982** configured to be rotatably coupled to the platform **964**. The body **982** includes an opening **984** defined in an upper surface **986** and an inner wall **988** extending downwardly from the opening **984**. The inner wall **988** defines a passageway **990** extending through the body **982** of the gear **972**. A plurality of splines **992** extend inwardly from the inner wall **988** into the passageway **990**.

The upper sleeve **940** of the lift device **886** is movably coupled to the guide gear **972**. The upper sleeve **940** includes an outer surface **994** having a plurality of grooves **996** defined therein. Each groove **996** is sized to receive one of the splines **992** of the gear **972**, thereby coupling the sleeve **940** to the guide gear **972** and permitting the sleeve **940** to

translate upwardly and downwardly relative to the gear **972**. As such, rotation of the guide gear **972** causes rotation of the upper sleeve **940** relative to the lower sleeve **942**. As described above, rotation of the upper sleeve **940** causes movement of the upper sleeve **940** upwardly or downwardly and changes the thickness of food items being processed by the food processor **810**.

As best seen in FIG. **27**, the drive gear **970** includes a body **1000** that is positioned in the compartment **960** of the base **812**. The body **1000** is pivotally coupled to a platform **964** of the base **812** via a pivot pin **1002**. The drive gear **970** includes a shaft **1004** that extends downwardly from the body **1000**. The shaft **1004** extends through a curved slot **1006** defined in the platform **964**.

The external control device **844** is configured to operate the lift device **886** and the gear assembly **888** to move the rotating disk **832** upwardly and downwardly and thereby change the thickness of food items processed by the food processor **810**. The control lever **846** of the external control device **844** is coupled to the drive gear **970**. The lever **846** includes an arm **1010** having a guide slot **1014** defined therein. The shaft **1004** of the gear **970** is positioned in the guide slot **1014**, thereby coupling the lever **846** to the gear **970**.

The arm **1010** extends outwardly through a horizontal track **1012** defined in the outer wall **962** of the base **812**. A grip **1016** of the user-operated device **844** is secured at the end of the arm **1010** positioned outside the base **812**. When the food processor is assembled, the grip **1016** is positioned below the removable bowl **820**. The arm **1010**, like the drive gear **970**, is pivotally coupled to the platform **964** such that the grip **1016** is movable between a plurality of adjustment positions relative to the base **812**.

In use, movement of the grip **1016** of the control lever **846** relative to the base **812** causes the arm **1010** to pivot and advance the shaft **1004** of the gear **970** along the slot **1006**. As the shaft **1004** advances along the slot **1006**, the drive gear **970** and guide gear **972** rotate. As described above, rotation of the guide gear **972** causes movement of the upper sleeve **940** upwardly or downwardly and changes the thickness of food items being processed by the food processor **810**. Each adjustment position of the grip **1016** corresponds to one of the preset cutting positions of the cutting assembly **816**.

Referring now to FIGS. **27** and **28**, the food processor **810** includes a locking mechanism **1020** configured to inhibit movement of the control lever **846** relative to the base **812** and thereby maintain the cutting assembly **816** at its current cutting position. The locking mechanism **1020** includes a pin **1022** positioned in an aperture **1024** defined in the platform **964**. The convex upper end **1026** of the pin **1022** is configured to be received in a plurality of concave notches **1028** defined in the bottom surface of the body **1000** of the drive gear **970**. Each notch **1028** corresponds to an adjustment position of the control lever **846** and hence a cutting position of the cutting assembly **816**.

As shown in FIG. **28**, a biasing element, such as spring **1030**, is positioned between the pin **1022** and the bottom surface **1032** of the aperture **1024**. The spring **1030** urges the pin **1022** into engagement with the notch **1028** corresponding to the present adjustment position of the control lever **846**. However, when the user desires to change the thickness of the food items being processed by the food processor **810**, the user may grab the grip **1016** and advance the control lever **846** along the track **1012**. Doing so moves the convex pin **1022** along the concave surface of the notch **1028** and overcomes the bias of the spring **1030**, thereby moving the

pin 1022 downward and permitting the pin 1022 to slide along the bottom surface of the gear 970 to the next notch 1028 corresponding to the next adjustment position.

In use, a user operates the controls 818 to energize the motor 814 to rotate the output shaft 850 and the drive stem 852. Because the cutting assembly 816 is secured to the drive stem 852 via the central shaft 854, rotation of the output shaft 850 causes rotation of the cutting assembly 816. While the motor 814 is energized, the user may advance food items into the processing chamber 826 through the feed tube 824 to be cut by the rotating cutting assembly 816.

If the user desires to change the cutting thickness during the cutting operation, the user may grab the grip 1016 and advance the control lever 846 along the track 1012 to another adjustment position. Movement of the control lever 846 causes the control lever 846 to pivot and rotate the drive gear 970 and guide gear 972. As described above, rotation of the guide gear 972 causes rotation of the upper sleeve 940 relative to the lower sleeve 942 and moves the upper sleeve 940 upwardly or downwardly relative to the base 812. Because the adaptor 884 is secured to both the upper sleeve 940 and the rotating disk 832, movement of the upper sleeve 940 causes movement of the disk 832 relative to the cutting blade 830, thereby changing the distance D between the cutting edge 838 of the cutting blade 30 and the upper surface 840 of the rotating disk 832 and, consequently, the thickness of food items being processed by the food processor 810.

Referring now to FIG. 29, another embodiment of a food processor (hereinafter referenced as a food processor 1110) is shown. Some features of the embodiment illustrated in FIG. 29 are substantially similar to those discussed above in reference to the embodiment of FIGS. 23-28. Such features are designated in FIG. 29 with the same reference numbers as those used in FIGS. 23-28.

The food processor 1110 has a base 812 that houses a motor 814 and a control unit. Under the control of the control unit, the motor 814 drives a cutting assembly 816 to cut food items such as cheeses, meats, fruits, and vegetables. The base 812 also includes one or more buttons, switches, dials, or other types of controls 818. A user operates the controls 818 to control the operation of the motor 814 and hence the food processor 1110. For example, one of the controls 818 may be operable to turn the motor 814 on and off while another control 818 may change the motor's speed.

As will be understood by those skilled in the art, the control unit may comprise analog and/or digital circuitry to process electrical signals received from the motor 814 (or other components of the food processor 1110) and provide electrical control signals to the motor or other components of the food processor 1110. For example, the control unit may be embodied as a microcontroller that executes firmware routines to control the operation of the food processor 1110.

The food processor 1110 also includes a removable receptacle or bowl 820 secured to the base 812, and the bowl 820 has a removable lid 822 secured to its upper peripheral edge. Collectively, the lid 822 and the bowl 820 define a processing chamber 826 where food items are processed by the cutting assembly 816.

As shown in FIG. 29, the cutting assembly 816 includes a cutting blade 830 and a rotating disk 832. A vertical distance, D, between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 defines a cutting thickness of food items processed by the cutting assembly 816. In other words, the thickness of the pieces of food items cut by the food processor 810 is

determined by the distance D between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832.

The food processor 1110 also includes a thickness adjustment assembly 1142, which is operable by a user to vary the cutting thickness of the food processor 810 while the cutting assembly 816 is driven by the motor 814, thereby creating thicker or thinner pieces of cut food items during a cutting operation. Like the thickness adjustment assembly 842 of the embodiment of FIGS. 23-28, the thickness adjustment assembly 1142 includes a two-piece adaptor 884 coupled to the rotating disk 832, a lift device 886 supporting the adaptor 884 and the rotating disk 832, and a gear assembly 888 positioned in the base 812. The thickness adjustment assembly 1142 also includes a motor 1144 (shown in diagrammatic form) that is coupled to the gear assembly 888 and operable to rotate the drive gear 970 and guide gear 972 of the gear assembly 888 and thereby raise and lower the rotating disk 832 relative to the cutting blade 830. A user operates a pair of buttons 1150 of the controls 818 to control the operation of the motor 1144 and hence the thickness adjustment assembly 842. In that way, the motor 1144 and buttons 1150 replace the control lever 846 as the mechanism by which the gear assembly 888 and lift device 886 are operated to change the thickness of the processed food items.

In other embodiments, the adjustment assembly may include other electromechanical components such that the user may adjust the cutting thickness at the touch of a button while the cutting assembly 816 is driven by the motor 814. The electromechanical components may include, for example, a small motor that would directly operate a screw-type drive assembly without a gear assembly while the other motor drives the cutting assembly. The electromechanical components may also include control circuitry to process electrical signals received from the second motor and provide electrical control signals to the second motor. For example, the control circuitry may be embodied as a microcontroller that executes firmware routines to control the operation the second motor to adjust the cutting thickness of the cutting assembly. Additional controls or buttons to control the operation of the second motor may be added to the food processor.

While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such an illustration and description is to be considered as exemplary and not restrictive in character, it being understood that only illustrative embodiments have been shown and described and that all changes and modifications that come within the spirit of the disclosure are desired to be protected.

For example, while food processor 810 is herein illustrated as a conventional domestic food processor, the features and aspects disclosed herein can also be implemented in other types of food processing devices such as automatic food choppers, slicers, dicers, ice shavers and the like. Additionally, while the cutting assembly 816 was illustratively embodied as an adjustable slicing disk attachment, the concept of an adjustable cutting assembly 816 can also be implemented with other cutting attachments, such as, for example, a shredding disk, grate/shaving disk, julienne disk, and the like.

It will also be appreciated that in other embodiments the threaded sleeves 940, 942 of the lift device 886 may be replaced with a series of ramp structures or cams that slide relative to one another to change the position of the rotating disk 832 relative to the cutting blade 830. Additionally, it will also be appreciated that in other embodiments the

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rotating disk may be vertically fixed and the cutting blade may be configured to move relative to the rotating disk to change the cutting thickness.

Other embodiments of a food processor are shown in greater detail in FIGS. 30-42. Some features of the embodiments illustrated in FIGS. 30-42 are substantially similar to those discussed above in reference to the embodiments of FIGS. 23-29. Such features are designated in FIGS. 30-42 with the same reference numbers as those used in FIGS. 23-29.

Referring now to FIGS. 30 and 31, another embodiment of a food processor (hereinafter food processor 1210) is shown. The food processor 1210 includes another embodiment of a cutting assembly (hereinafter cutting assembly 1216) and another embodiment of a removable lid (hereinafter lid 1228), which engages the cutting assembly to seat the cutting assembly on the drive stem, as described in greater detail below.

As shown in FIG. 30, the food processor 1210 has a base 812 that houses a motor 814 and a control unit (not shown). Under the control of the control unit, the motor 814 drives the cutting assembly 1216 to cut food items such as cheeses, meats, fruits, and vegetables. The food processor 1210 also includes a removable receptacle or bowl 820 that is secured to the base 812. The bowl 820 has an upper rim 1222 and an inner wall 1224 that extends downwardly from the upper rim 1222 to define part of a processing chamber 826 where food items may be processed by the cutting assembly 1216.

The removable lid 1228 is configured to be secured to the rim 1222 of the bowl 820. In that way, the removable lid 1228 and the bowl 820 cooperate to define the processing chamber 826. The lid 1228 also has a feed tube 824 formed thereon through which food items such as fruits and vegetables may be inserted into the bowl 820 to be processed by the food processor 810. The lid 1228 of the food processor 1210 includes a shell 1230, and the feed tube 824 extends upwardly from the outer surface 1234 of the shell 1230. The shell 1230 has a sleeve 1236 that extends downwardly from an inner surface 1238 thereof. The sleeve 1236 has an opening 1240 defined in a lower end 1242, and an inner wall 1244 that extends from the opening 1240 to define an aperture 1246 in the sleeve 1236.

As described above, the cutting assembly 1216 of the food processor 1210 is driven by the motor 814 to cut food items. The motor 814 includes an output shaft 850 extending upwardly from the base 812. The output shaft 850 is coupled to a drive stem 1252, which is in turn configured to be secured to the cutting assembly 1216. The cutting assembly 1216 includes a rotating disk 1232 and a blade assembly 1256, and the blade assembly 1256 includes a cutting blade 830 that is secured to a blade carrier 1248. The blade carrier 1248 has a central shaft 1254 and a mounting arm 862 that extends outwardly from the central shaft 1254. The cutting blade 830 is secured to the upper surface of the mounting arm 862 via a number of fasteners 864. Like the embodiments of FIG. 23-29, the rotating disk 1232 is configured to slide vertically relative to the cutting blade 830 to adjust the cutting thickness of the cutting assembly 1216, as described in greater detail below.

The central shaft 1254 of the blade carrier 1248 has a socket 1258 formed in its lower end, and the drive stem 1252 has an upper end 1260 that is keyed to match the configuration of the socket 1258. In the illustrative embodiment, the upper end 1260 includes two flat surfaces (not shown) connected at each end by a curved surface (not shown), and the socket 1258 has a corresponding geometric shape that is sized to receive the upper end 1260 of the drive stem 1252.

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When the cutting assembly 1216 is seated on the drive stem 1252, as shown in FIG. 31, the keyed upper end 1260 of the stem 1252 is received in the socket 1258 of the central shaft 1254. As such, rotation of the output shaft 50 of the motor 14 causes rotation of the cutting assembly 1216.

It should be appreciated that in other embodiments the arrangement of the socket and keyed end may be reversed, with the keyed end being formed on the central shaft 1254 and the socket being defined in the drive stem 1252. It should also be appreciated that in other embodiments other methods of attachment may be used to secure the drive stem to the cutting assembly.

As shown in FIGS. 30 and 31, the drive stem 1252 of the food processor 1210 includes a center rod 1262 that extends outwardly through an opening 1264 defined in the upper end 1266 of the blade carrier 1248. The aperture 1246 of the sleeve 1234 of the lid 1228 is sized to receive the center rod 1262 such that the tip 1268 of the center rod 1262 may be positioned in the aperture 1246 when the lid 1228 is secured to the bowl 820, as shown in FIG. 31. Additionally, when the lid 1228 is secured to the bowl 820, the lower end 1242 of the sleeve 1234 of the lid 1228 engages the upper end 1260 of the blade carrier 1248 to seat the blade assembly 1256 on the drive stem 1252, as described in greater detail below.

The rotating disk 1232 of the cutting assembly 1216 includes a central hub 1270, a planar body 872 extending radially outward the central hub 1270, and a rim 874 extending upwardly from the outer perimeter of the planar body 872. The hub 1270 of the rotating disk 1232 has a sidewall 1276 that defines a passageway 1278 extending through the hub 1270. As shown in FIG. 30, the central shaft 1254 of the blade assembly 1256 is positioned in the passageway 1278, and the center rod 1262 of the drive stem 1252 extends outwardly through an upper opening 1272 of the passageway 1278. The hub 1270 also has a pocket 880 defined in the sidewall 1276 that opens into the passageway 1278. The mounting arm 862 of the blade assembly 856 is received in the pocket 880, thereby torsionally securing the blade assembly 1256 to the rotating disk 832. In the illustrative embodiment, the central shaft 1254, the mounting arm 862, and the hub 1270 are keyed such that the blade assembly 1256 is torsionally secured to the rotating disk 1232. As such, rotation of the output shaft 850 causes rotation of the rotating disk 1232 and the cutting blade 830.

The food processor 1210 also includes a thickness adjustment assembly 842, which is operable to move the rotating disk 1232 relative to the cutting blade 830. The adjustment assembly 842 includes a two-piece adaptor 884, a lift device 886 supporting the adaptor 884 and the rotating disk 1232, and a gear assembly 888 positioned in the base 812. The lift device 886 is operable to move the adaptor 884 (and hence rotating disk 1232) upwardly and downwardly relative to the base 812 of the food processor 1210, and the gear assembly 888 is configured to operate the lift device 886. As in the embodiment described above in regard to FIGS. 23-28, the food processor 1210 includes an external control device (not shown) that is configured to operate the lift device 886 and the gear assembly 888 to move the rotating disk 1232 upwardly and downwardly, thereby changing the thickness of food items processed by the food processor 1210.

As shown in FIGS. 30 and 31, the adaptor 884 of the adjustment assembly 842 includes an upper shaft 890 configured to be secured to the hub 1270 of the rotating disk 1232. The upper shaft 890 has a cylindrical body 894 that extends from an upper end 896 to a lower end 898. The upper end 896 of the upper shaft 890 has a pair of tabs 900 extending outwardly therefrom. When the upper shaft 890 is

secured to the hub 1270, each tab 900 is positioned in a corresponding slot 902 defined in the hub 1270, as shown in FIGS. 30 and 31. In that way, the shaft 890 is secured to the rotating disk 832 such that rotation of the rotating disk 832 causes rotation of the shaft 890. At the lower end 898 of the shaft 890, a plurality of teeth 910 are formed in the body 894 and are configured to engage a plurality of teeth 918 formed on the lower shaft 892 to thereby torsionally secure the upper shaft 890 to the lower shaft 892.

The upper shaft 890 of the adaptor 884 also includes an inner wall 906 that defines a passageway 908 through the body 894. When assembled with the base 812 and the cutting assembly 1216, the upper shaft 890 is positioned over the drive stem 1252 and the lower end of the central shaft 1254 of the blade assembly 1256 such that the stem 1252 and the shaft 1254 are received in the passageway 808 of the upper shaft 890.

As shown in FIGS. 30 and 31, the upper shaft 890 includes a biasing mechanism 920 positioned in the passageway 908, and the biasing mechanism 920 is configured to bias the upper shaft 890 into engagement with the lower shaft 892. The biasing mechanism 920 includes a sleeve 922 positioned in the middle of the passageway 908. When attached to the base 812, the sleeve 922 has the drive stem 1252 of the motor 814 extending therethrough.

The sleeve 922 of the biasing mechanism 920 includes an upper rim 924 that contacts the lower surface 926 of the central shaft 1254 of the blade assembly 856 when the upper shaft 890 is secured to the rotating disk 832. A flange 928 extends outwardly from the upper rim 924 of the sleeve 922. Similarly, the inner wall 906 of the upper shaft 890 includes an inner flange 930 extending inwardly into the passageway 908. A biasing element, such as a spring 932, is positioned between the flanges 928, 930.

To assemble the food processor 1210 for use, the user may operate the thickness adjustment assembly 842 to position the lift device 886 in a position corresponding to the minimal cutting thickness, as shown in FIG. 30. The user may align the upper shaft 890 of the adaptor 884 in the bowl 820 and advance the upper shaft 890 downward so that the drive stem 1252 enters the passageway 908 of the upper shaft 890. The user may continue to advance the upper shaft 890 downward until the teeth 910 on the lower end 898 of the upper shaft 890 engage the teeth 918 on the upper end 914 of the lower shaft 892 of the adaptor 884.

The user may secure the upper shaft 890 of the adaptor 884 to the hub 1270 of the rotating disk 1232. To do so, the user may align the cutting assembly 1216 with the drive stem 1252 and advance the cutting assembly 1216 downward so that the drive stem 1252 enters the socket 1258 defined in the central shaft 1254 of the blade carrier 1248. The user may continue to advance the cutting assembly 1216 downward until the tabs 900 of the adaptor 884 are received in the slots 902 defined in the hub 1270, as shown in FIG. 30. In that position, the lower surface 926 of the central shaft 1254 contacts the upper rim 1224 of the sleeve 1222 of the biasing mechanism 920. Because the cutting blade 830 is not fixed axially, the cutting blade 830 is permitted to move in the direction indicated by the arrow 1280. As shown in FIG. 30, the spring 932 urges the cutting blade 830 into a position in which the distance D defined between the cutting edge 838 of the cutting blade 830 and the upper surface 40 of the rotating disk 832 is increased.

The user may attach the lid 1228 to the upper rim 1222 of the bowl 820. To do so, the user aligns the sleeve 1234 of the lid 1228 with the tip 1268 of the center rod 1262 of the drive stem 1252. The user then advances the lid 1228 downward

such that the lower end 1242 of the sleeve 1234 engages the upper end 1260 of the blade carrier 1248. As the user continues to advance the lid 1228 downward, the bias exerted by the spring 932 is overcome, and the cutting blade 830 is moved downward such that the distance D defined between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 is decreased. As shown in FIG. 31, when the shell 1230 of the lid 1228 contacts the upper rim 1222 of the bowl 820, the distance D defined between the cutting edge 838 of the cutting blade 830 and the upper surface 840 of the rotating disk 832 is relatively minimal, corresponding to the minimal cutting thickness of the cutting assembly 1216.

It should be appreciated that the user may also attach the upper shaft 890 of the adaptor 884 to the cutting assembly 1216 prior to attaching the assembly to the lower shaft 892 of the adaptor 884. Additionally, it should also be appreciated that the food processor 1210 may be assembled with the lift device 886 in a position corresponding to any cutting thickness, including, for example, the maximum cutting thickness, rather than the minimal cutting thickness as shown in the illustrative embodiment.

Referring now to FIG. 32, another embodiment of a base (hereinafter base 1412) is shown. The base 1412 may be used with, for example, the other components of the food processor 810 described above in regard to FIGS. 23-28 or the components of the food processor 1210 described above in regard to FIGS. 30 and 31. The base 1412 includes another embodiment of a thickness adjustment assembly (hereinafter adjustment assembly 1442). The adjustment assembly 1442 includes a user-control device 1444 that is embodied as a thumbwheel 1446 that can be turned by a user to adjust the cutting thickness of the food processor 810, as described in greater detail below.

The base 1412 houses a motor 814 and a control unit. A bowl 820 may be secured to the base 1412, and a lid (not shown) may be secured to the bowl 820. Collectively, the lid and the bowl 820 define a processing chamber 826. Under the control of the control unit, the motor 814 drives a cutting assembly, such as, for example, the cutting assembly 816, which was described above in reference to FIGS. 23-28, or the cutting assembly 1216, which was described above in reference to FIGS. 30 and 31, to cut food items such as cheeses, meats, fruits, and vegetables in the processing chamber 826. The base 1412 also includes one or more buttons, switches, dials, or other types of controls 818. A user operates the controls 818 to control the operation of the motor 814 and hence the food processor.

The motor 814 includes an output shaft 850 extending upwardly from the base 812. The output shaft 850 is coupled to a drive stem (not shown), which is in turn configured to be secured to the cutting assembly. As described above in reference to FIGS. 23-28, the cutting assembly includes a cutting blade and a rotating disk configured to move upwardly and downwardly relative to the cutting blade to adjust the cutting thickness of the cutting assembly.

The thickness adjustment assembly 1442, like the adjustment assembly 842 of FIGS. 23-28, includes a two-piece adaptor 884 configured to be coupled to the cutting assembly and a lift device 886 supporting the adaptor 884. The lift device 886 is operable to move the adaptor 884 upwardly and downwardly relative to the base 1412, and, in that way, change the position of the rotating disk of the cutting assembly relative to the cutting blade of the cutting assembly, thereby adjusting the cutting thickness.

The adjustment assembly 1442 also includes a gear assembly 1488 is positioned in the base 1412. Similar to the



gear assembly **888** described above in reference to FIGS. **23-28**, the gear assembly **1488** is configured to operate the lift device **886**. The thumbwheel **1446** is configured to operate the gear assembly **1488** (and hence the lift device **886**) to change the thickness of the food items produced by the food processor.

The lift device **886** of the adjustment assembly **1442** includes a screw-type drive assembly that may be operated to adjust the position of the rotating disk of the cutting assembly relative to the base **812**. As described above, it should be appreciated that in other embodiments the lift device may take the form of, for example, a series of ramp structures or cams that slide relative to one another to change the cutting thickness of the cutting assembly. The screw-type drive assembly includes an internally-threaded upper sleeve **940** that threadingly engages an externally-threaded lower sleeve (not shown) such that the upper sleeve **940** may be moved upwardly or downwardly relative to the base **812** by rotating the upper sleeve **940**. For example, counter-clockwise rotation of the upper sleeve **940** may cause downward movement of the upper sleeve **940**, while clockwise rotation of the upper sleeve **940** may cause upward movement of the upper sleeve **940**.

As shown in FIG. **32**, the adaptor **884** of the adjustment assembly **1442**, like the adaptor **884** of FIGS. **23-28**, includes an upper shaft (not shown) that is secured to the cutting assembly and a lower shaft **892** that is configured to be torsionally secured to the upper shaft. The lower shaft **892** is rotatably coupled to the upper sleeve **940** of the lift device **886**. In that way, when the upper shaft is secured to the lower shaft **892**, the assembled adaptor **884** (and hence the cutting assembly) is permitted to rotate relative to the upper sleeve **940**. The lower shaft **892** is fixed axially relative to the upper sleeve **940** such that upward and downward movement of the upper sleeve **940** causes upward and downward movement of the lower shaft **892** of the adaptor **884**. As described above in reference to FIGS. **23-28**, when the adaptor **884** is assembled and the cutting assembly is secured thereto, the upward and downward movement of the upper sleeve **940** is thereby translated to the cutting assembly such that the rotating disk of the cutting assembly slides relative to the cutting blade to change the cutting thickness of the cutting assembly.

As shown in FIG. **32**, the adjustment assembly **1442** also includes a gear assembly **1488** that is configured to operate the lift device **886**. The base **1412** has a compartment **960** that is defined by an outer wall **962**, and the gear assembly **1488** is positioned in the compartment **960**. The gear assembly **1488** includes a drive gear **1490** and a guide gear **972** that are pivotally coupled to a platform **964** of the base **1412**. The drive gear **1490** includes a body **1492** that is pivotally coupled to a platform **964** of the base **1412** via a pivot pin **1002**. The body **1492** of the gear **1490** has a plurality of teeth **1496** defined on at least a portion of an outer surface **1498** thereof.

The guide gear **972** of the gear assembly **1488** has a body **982** configured to be rotatably coupled to the platform **964**. The body **982** of the gear **972** has a plurality of teeth **976** defined on an outer surface **980** thereof. A number of the teeth **1496** of the drive gear **1490** are interdigitated with a number of the teeth **976** of the guide gear **972** such that rotation of the drive gear **1490** causes rotation of the guide gear **972**.

The upper sleeve **940** of the lift device **886** is movably coupled to the guide gear **972**. The body **982** of the guide gear **972** includes an opening **984** and an inner wall **188** extending downwardly from the opening **984**. A plurality of

splines **992** extend inwardly from the inner wall **988** of the gear **972**. The upper sleeve **940** of the lift device **886** includes an outer surface **994** that has a plurality of grooves **996** defined therein, and each groove **996** is sized to receive one of the splines **992** of the gear **972**, thereby coupling the sleeve **940** to the guide gear **972**. As such, rotation of the guide gear **972** causes rotation of the upper sleeve **940** relative to the lower sleeve, which results in the sleeve **940** translating upwardly or downwardly relative to the base **1412**.

As described above, the adjustment assembly **1442** includes a thumbwheel **1446** that is configured to operate the gear assembly **1288** (and hence the lift device **886**) to change the thickness of the food items produced by the food processor. In the illustrative embodiment, the thumbwheel **1446** includes a grip **1500** defined on a portion of the outer surface **1498** of the drive gear **1490**. As shown in FIG. **32**, the outer wall **962** of the base **1412** has a slot **1502** defined therein, and the grip **1500** extends outwardly through the slot **1502** such that a user may access the grip **1500** to operate the gear assembly **1488**.

As shown in FIG. **32**, the base **1412** has a plurality of position markings **1504** defined thereon. Each position marking **1504** corresponds to an adjustment position of the adjustment assembly **1442**, which in turn corresponds to one of a number of preset cutting positions of the cutting assembly. The grip **1500** of the control device **1444** also includes an indicator **1506** that may be aligned with one of the position markings **1504** to indicate the present position of the adjustment assembly **1442** and hence the cutting position of the cutting assembly. It should be appreciated that the base **1412**, like the base **812** described above in regard to FIGS. **23-28**, may include a locking mechanism configured to inhibit movement of the thumbwheel **1446** and thereby maintain the cutting assembly at a particular cutting position.

In use, a user operates the controls **818** to energize the motor **814** to rotate the output shaft **850**. When the cutting assembly is secured the output shaft **850** via the drive stem, rotation of the output shaft **850** causes rotation of the cutting assembly. While the motor **814** is energized, the user may advance food items into the processing chamber **826** to be cut by the rotating cutting assembly.

If the user desires to change the cutting thickness during the cutting operation, the user may grasp the grip **1500** and rotate the thumbwheel **1446**. As described above, rotation of the grip **1500** causes rotation of the drive gear **1490**. As the drive gear **1490** is rotated, the guide gear **972** is also rotated, which causes the upper sleeve **940** of the lift device **886** to rotate and translate upwardly or downwardly relative to the base **1412**. As described above, the vertical movement of the upper sleeve **940** moves the adaptor **884** and the rotating disk relative to the cutting blade and the base **1412** while the cutting blade remains fixed vertically. In that way, the thickness of food items cut by the cutting assembly may be adjusted while the cutting assembly is driven by the motor **814**.

Referring now to FIGS. **33** and **34**, another embodiment of a food processor (hereinafter food processor **1510**) is shown. In the food processor **1510**, the base **812** described above in regard to FIGS. **23-28** has been replaced by a base **1512** that houses a motor **814** and a control unit. The food processor **1510**, like the food processor **810** described above in regard to FIGS. **23-28**, also includes a bowl **820** that is secured to the base **1512** and a lid **822** that is configured to be secured to the bowl **820**. Collectively, the lid **822** and the bowl **820** define a processing chamber **826**.

Under the control of the control unit, the motor **814** drives a cutting assembly **816** to cut food items such as cheeses, meats, fruits, and vegetables in the processing chamber **826**. In other embodiments, the food processor **1510** may include another cutting assembly, such as, for example, the cutting assembly **1416**, which was described above in reference to FIGS. **30** and **31**. The base **1512** also includes one or more buttons, switches, dials, or other types of controls **818**. A user operates the controls **818** to control the operation of the motor **814** and hence the food processor **1510**.

The cutting assembly **816** of the food processor **1510** is driven by the motor **814** to cut food items. The motor **814** includes an output shaft **850** extending upwardly from the base **812**. The output shaft **850** is coupled to a drive stem **852**, which is in turn configured to be secured to the cutting assembly **816**. As described above in reference to FIGS. **23-28**, the cutting assembly **816** includes a cutting blade **830** and a rotating disk **832** configured to move upwardly and downwardly relative to the cutting blade **830** to adjust the cutting thickness of the cutting assembly **816**.

The food processor **1510** includes another embodiment of a thickness adjustment assembly (hereinafter adjustment assembly **1542**) that is operable by a user to vary the cutting thickness of the cutting assembly **816** during a cutting operation. The adjustment assembly **1542** includes a user-operated control device **1544** that is located outside of the processing chamber **826** of the food processor **1510**. In the illustrative embodiment of FIGS. **33** and **34**, the control device **1544** is embodied as a control knob **1546** that is positioned above the controls **818** of the base **1512**. A shaft **1548** extends inwardly from the control knob **1546** through an opening **1550** defined in an outer wall **962** of the base **1512**. The control knob **1546** includes a grip **1552**, and a user may grasp the grip **1552** to rotate the control knob **1546** clockwise or counter-clockwise to change the distance **D** defined between a cutting edge **838** of a cutting blade **830** and an upper surface **840** of the rotating disk **832** of the cutting assembly **816**.

The thickness adjustment assembly **1542** also includes a two-piece adaptor **884** that is coupled to the cutting assembly **816**, as shown in FIG. **33**. The adaptor **884** is supported by a lift device **886**, which is operable to move the adaptor **884** upwardly or downwardly relative to the base **1512** of the food processor **1510**. As described above in reference to FIGS. **23-28**, the rotating disk **832** of the cutting assembly **816** is also moved upwardly or downwardly with the adaptor **884** such that the distance **D** (and hence the cutting thickness) is increased or decreased. The adjustment assembly **1542** also includes a gear assembly **1588** positioned in the base **1512**. The gear assembly **1588** is configured to operate the lift device **886**. The control knob **1546** is configured to operate the gear assembly **1588** (and hence the lift device **886**) to change the thickness of the food items produced by the food processor **1510**.

The lift device **886** of the adjustment assembly **1542** includes a screw-type drive assembly that may be operated to adjust the position of the rotating disk of the cutting assembly relative to the base **812**. The screw-type drive assembly includes an internally-threaded upper sleeve **940** (see FIG. **34**) that threadingly engages an externally-threaded lower sleeve (not shown) such that the upper sleeve **940** may be moved upwardly or downwardly relative to the base **812** by rotating the upper sleeve **940**.

As shown in FIG. **33**, the adaptor **884** of the adjustment assembly **1542** includes an upper shaft **890** that is secured to the rotating disk **832** of the cutting assembly **816**, and a lower shaft **892** that is rotatably coupled to the upper sleeve

**940** of the lift device **886**. In that way, the adaptor **884** (and hence the cutting assembly) is permitted to rotate relative to the upper sleeve **940**. The lower shaft **892** is fixed axially relative to the upper sleeve **940** such that upward and downward movement of the upper sleeve **940** of the lift device **886** causes upward and downward movement of the lower shaft **892** of the adaptor **884**.

As shown in FIG. **34**, the adjustment assembly **1542** also includes a gear assembly **1588** that is configured to operate the lift device **886**. The base **1512** has a compartment **960** that is defined by the outer wall **962**, and the gear assembly **1588** is positioned in the compartment **960**. The gear assembly **1588** includes a drive gear **1590** and a guide gear **1592**. In the illustrative embodiment the drive gear **1590** includes a worm or screw **1594**, and the guide gear **1592** is a worm gear **1596** that meshes with the screw **1594**.

The worm gear **1596** of the gear assembly **1588** has a body **1598** that is rotatably coupled to the base **1512**. The body **1598** of the gear **1596** has a plurality of teeth **1602** defined thereon. The screw **1594** of the drive gear **1590** also includes a plurality of teeth **1606** that are interdigitated with a number of the teeth **1602** of the worm gear **1596**. As a result, rotation of the drive gear **1490** causes rotation of the worm gear **1596**.

The upper sleeve **940** of the lift device **886** is movably coupled to the worm gear **1596**. As shown in FIG. **34**, the body **1598** of the worm gear **1596** includes an opening **984** and an inner wall **988** extending downwardly from the opening **984**. A plurality of splines **992** extend inwardly from the inner wall **988** of the worm gear **1596**. The upper sleeve **940** of the lift device **886** includes an outer surface **994** that has a plurality of grooves **996** defined therein, and each groove **996** is sized to receive one of the splines **992** of the worm gear **1596**, thereby coupling the sleeve **940** to the worm gear **1596**. As such, rotation of the worm gear **1596** causes rotation of the upper sleeve **940** relative to the lower sleeve **942**, which results in the sleeve **940** translating upwardly or downwardly relative to the base **1512**.

The gear assembly **1588** also includes a drive shaft **1510** connected to the screw **1594**. The shaft **1510** has an external gear, such as, for example, a spur gear **1512** attached at an end **1514** thereof. As shown in FIG. **34**, the spur gear **1612** has a plurality of teeth **1616** defined thereon. The gear assembly **1588** includes another external gear, such as, for example, a spur gear **1620**, which is attached at an end **1622** of the shaft **1548** of the control device **1544**. The spur gear **1620** has a plurality of teeth **1624** defined thereon that are interdigitated with the teeth **1616** of the spur gear **1612** of the drive shaft **1610**. In that way, the control knob **1546** of the control device **1544** is connected to the gear assembly **1588** such that rotation of the control knob **1546** results in rotation of the screw **1594** and the gears **1596**, **1612**, and **1620**.

In use, a user may operate the controls **818** to energize the motor **814** to rotate the output shaft **850**. Because the cutting assembly **816** is secured the output shaft **850** via the drive stem **852**, rotation of the output shaft **850** causes rotation of the cutting assembly **816**. While the motor **814** is energized, the user may advance food items into the processing chamber **826** to be cut by the rotating cutting assembly.

If the user desires to change the cutting thickness during the cutting operation, a user may grasp the grip **1552** of the control knob **1546** and rotate the control knob **1546** clockwise or counter-clockwise while the cutting assembly **816** is driven by the motor **814**. As the control knob **1546** is rotated, the spur gear **1620** on the shaft **1548** acts on the spur gear **1512** of the drive gear **1590** to rotate the drive gear **1590**

about its longitudinal axis **1626**. Rotation of the drive gear **1590** causes the screw **1594** to act on the worm gear **1596**, which results in rotation of the worm gear **1596**. As described above, rotation of the worm gear **1596** causes rotation of the upper sleeve **940**, and the sleeve **940** (and hence the adaptor **884** and the rotating disk **832**) translates upwardly or downwardly relative to the base **1512**. In that way, the distance D defined between a cutting edge **838** of a cutting blade **830** and an upper surface **840** of the rotating disk **832** of the cutting assembly **816** may be changed, resulting in thicker or thinner food items.

It should be appreciated that the food processor **1510** may include one or more position markings that correspond to preset cutting positions for the cutting assembly **816**. It should also be appreciated that the food processor **1510**, like the food processor **810** described above in regard to FIGS. **23-28**, may include a locking mechanism configured to inhibit movement of the control knob **1546** and thereby maintain the cutting assembly **816** at a particular cutting position. In other embodiments, the gear assembly may include other gear arrangements to translate the rotation of the control knob **1546** into movement of the rotating disk. For example, referring now to FIG. **35**, another embodiment of a gear assembly (hereinafter gear assembly **988**) is shown.

Similar to the gear assembly **1588**, the gear assembly **1688** is configured to operate the lift device **886**. The gear assembly **1688** is positioned in the compartment **960** of the base **1512**, and the gear assembly **1688** includes a guide gear **1690**, a rack gear **1692**, and a pinion gear **1694** that are movably coupled to the base **1512**. The guide gear **1690** of the gear assembly **1688** has a body **982** configured to be rotatably coupled to the base **1512**. The body **982** of the gear **1590** has a plurality of teeth **976** defined on an outer surface **980** thereof.

As shown in FIG. **35**, the upper sleeve **940** of the lift device **886** is movably coupled to the guide gear **1590**. The body **982** of the guide gear **1590** includes an opening **984** and an inner wall **988** extending downwardly from the opening **984**. A plurality of splines **992** extend inwardly from the inner wall **988** of the gear **1590**. The upper sleeve **940** of the lift device **886** includes an outer surface **994** that has a plurality of grooves **996** defined therein, and each groove **996** is sized to receive one of the splines **992** of the gear **1590**, thereby coupling the sleeve **940** to the guide gear **1590**. As such, rotation of the guide gear **1690** causes rotation of the upper sleeve **940** relative to the lower sleeve **942**, which results in the sleeve **940** translating upwardly or downwardly relative to the base **1512**.

As described above, the external control device **1544** of the food processor **1510** includes a control knob **1546** and a shaft **1548** extending inwardly from the control knob **1546** into the base **1512**. The shaft **1548** has the pinion gear **1694** of the gear assembly **1688** secured at an end **1622** thereof. The pinion gear **1694** is an external gear that has a plurality of teeth **1696** defined on an outer surface thereof.

The pinion gear **1694** of the gear assembly **1688** meshes with the rack gear **1692**. The rack gear **1692** includes a rectangular body **1700** that is configured to slide along a longitudinal axis **1702**. The rack gear **1692** has a plurality of teeth **1704** defined on one side **1706** of the body **1700** and another plurality of teeth **1708** defined on a bottom side **1810**. As shown in FIG. **35**, a number of the teeth **1704** of the rack gear **1692** are interdigitated with a number of the teeth **976** of the guide gear **1690**. Additionally, a number of the teeth **1708** of the rack gear **1692** are interdigitated with a number of the teeth **1696** of the pinion gear **1694**. As a result, when the pinion gear **1694** is rotated, the rack gear

**1692** is moved along the axis **1702**, thereby causing the guide gear **1690** to rotate such that the upper sleeve **940** rotates and translates upwardly or downwardly relative to the base **1512**.

In use, while the cutting assembly is driven by the motor **814**, a user may grasp the grip **1552** of the control knob **1546** and rotate the control knob **1546** clockwise or counterclockwise while the cutting assembly **816** is driven by the motor **814**. As the control knob **1546** is rotated, the pinion gear **1594** of the gear assembly **1688** is rotated. Rotation of the pinion gear **1694** causes the rack gear **1692** to slide along the axis **1702** and thereby rotate the guide gear **1690**. As described above, rotation of the guide gear **1690** causes rotation of the upper sleeve **940**, and the sleeve **940** (and hence the adaptor **884** and the rotating disk **832**) translates upwardly or downwardly relative to the base **1512**. In that way, the distance D defined between a cutting edge **838** of a cutting blade **830** and an upper surface **840** of the rotating disk **832** of the cutting assembly **816** may be changed, resulting in thicker or thinner food items.

Referring now to FIGS. **36** and **37**, another embodiment of a food processor (hereinafter food processor **1810**) is shown. In the food processor **1810**, the base **812** and the bowl **820** described above in regard to FIGS. **23-28** have been replaced by a base **1812** and a bowl **1820** that includes another embodiment of a thickness adjustment assembly (hereinafter adjustment assembly **1842**). The adjustment assembly **1842** includes a user-control device **1844** that is embodied as a control strip **1846** rotatably coupled to the bowl **1820**. The strip **1846** includes a grip **1848** that can be operated by a user to adjust the cutting thickness of the food processor **1810**, as described in greater detail below.

The base **1812** of the food processor **1810** houses a motor **814** and a control unit. Under the control of the control unit, the motor **814** drives a cutting assembly **816** to cut food items such as cheeses, meats, fruits, and vegetables. The base **1812** also includes one or more buttons, switches, dials, or other types of controls **818**. A user operates the controls **818** to control the operation of the motor **814** and hence the food processor **1810**.

The removable receptacle or bowl **1820** is secured to the base **1812** and has a removable lid **822** secured thereto. The bowl **1820** has an upper rim **1822** and an inner wall **1824** that extends downwardly from the upper rim **1822** to define part of a processing chamber **826** where food items may be processed by the cutting assembly **816**. The removable lid **822** is secured to the rim **1822** of the bowl **1820**. In that way, the removable lid **822** and the bowl **1820** cooperate to define the processing chamber **826**.

The bowl **1820** of the food processor **1810** has a lower rim **1826** that is positioned below the processing chamber **826**. The strip **1846** of the control device **1844** is attached to the lower rim **1826**, and is configured to rotate relative to the lower rim **1826**. In the illustrative embodiment, a portion of the strip **1846** is received in a track (not shown) defined in the lower rim **1826** such that the strip **1846** is rotatably coupled to the bowl **1820**. It should be appreciated that in other embodiments the strip **1846** may be secured to the bowl **1820** by any combination of pins, tabs, slots, or openings that permit the strip **1846** to rotate relative to the bowl **1820**. It should also be appreciated that in other embodiments the control strip may be rotatably coupled to the base rather than the bowl or may be a separate component.

The cutting assembly **816** of the food processor **1810** is driven by the motor **814** to cut food items. The motor **814** includes an output shaft **850** extending upwardly from the

base **812**. The output shaft **850** is coupled to a drive stem **852**, which is in turn configured to be secured to the cutting assembly **816**. As described above in reference to FIGS. **23-28**, the cutting assembly **816** includes a cutting blade **830** and a rotating disk **832** configured to move upwardly and downwardly relative to the cutting blade **830** to adjust the cutting thickness of the cutting assembly **1816**.

As shown in FIGS. **36** and **37**, the adjustment assembly **1842** of the food processor **1810** includes a two-piece adaptor **884** coupled to the cutting assembly **816**, a lift device **86** supporting the adaptor **884** and the cutting assembly **816**, and a gear assembly **1888** positioned in the base **1812**. The lift device **886** is operable to move the adaptor **884** upwardly and downwardly relative to the base **1812**, and, in that way, change the thickness of food items cut by the cutting assembly. The gear assembly **1888** is configured to operate the lift device **886**, and the control strip **1846** is configured to operate the gear assembly **1888** (and hence the lift device **886**) to change the thickness of the food items produced by the food processor **1810**.

The lift device **886** of the adjustment assembly **1842** includes a screw-type drive assembly that may be operated to adjust the position of the rotating disk of the cutting assembly relative to the base **1812**. The screw-type drive assembly includes an internally-threaded upper sleeve **940** that threadingly engages an externally-threaded lower sleeve (not shown) such that the upper sleeve **940** may be moved upwardly or downwardly relative to the base **1812** by rotating the upper sleeve **940**.

As shown in FIG. **36**, the adaptor **884** of the adjustment assembly **1842** includes an upper shaft **890** that is secured to the rotating disk **832** of the cutting assembly **816**, and a lower shaft **892** that is rotatably coupled to the upper sleeve **940** of the lift device **886**. In that way, the adaptor **884** (and hence the cutting assembly) is permitted to rotate relative to the upper sleeve **940**. The lower shaft **892** is fixed axially relative to the upper sleeve **940** such that upward and downward movement of the upper sleeve **840** of the lift device **886** causes upward and downward movement of the lower shaft **892** of the adaptor **884**.

As shown in FIG. **37**, the adjustment assembly **1842** also includes a gear assembly **1888** that is configured to operate the lift device **886**. The base **1812** has a compartment **960** that is defined by an outer wall **1962**, and the gear assembly **1888** is positioned in the compartment **960**. The gear assembly **1888** includes a drive gear **1970** and a guide gear **972** that are pivotally coupled to a platform **964** of the base **1912**. A slot **1964** is defined in the outer wall **1962** of the base **1912**, and the drive gear **1970** includes a body **1974** that is partially positioned in the slot **1964**. The body **1974** of the drive gear **1970** is pivotally coupled to a platform **964** of the base **1812** via a pivot pin **1002**. The body **1974** also has a plurality of teeth **1976** defined on an outer surface **1978** thereof.

The guide gear **972** of the gear assembly **1888** has a body **982** that is configured to be rotatably coupled to the platform **964**. The body **982** of the gear **972** has a plurality of teeth **976** defined on an outer surface **980** thereof. A number of the teeth **1976** of the drive gear **1970** are interdigitated with a number of the teeth **976** of the guide gear **972** such that rotation of the drive gear **1970** causes rotation of the guide gear **972**.

The upper sleeve **940** of the lift device **886** is movably coupled to the guide gear **972**. The body **982** of the guide gear **972** includes an opening **984** defined in an upper surface **986** and an inner wall **988** extending downwardly from the opening **984**. A plurality of splines **992** extend

inwardly from the inner wall **988** of the gear **972**. The upper sleeve **940** of the lift device **886** includes an outer surface **994** that has a plurality of grooves **996** defined therein, and each groove **996** is sized to receive one of the splines **992** of the gear **972**, thereby coupling the sleeve **940** to the guide gear **972**. As such, rotation of the guide gear **972** causes the rotation of the upper sleeve **940** relative to the lower sleeve **942**, which results in the sleeve **940** translating upwardly or downwardly relative to the base **1912**.

As shown in FIG. **37**, the control strip **1846** includes a ring body **1980** that extends around the outer circumference of the wall **1962**. The ring body **1980** has an outer surface **1982** and an inner surface **1984** positioned opposite the outer surface **1982**. A plurality of teeth **1986** are defined on the inner surface **1984**, and a number of the teeth **1986** are interdigitated with a number of the teeth **1976** of the drive gear **1970**. As such, rotation of the control strip **1846** in either direction indicated by arrow **1990** causes the rotation of the drive gear **1970** and the guide gear **972**. The grip **1848** of the control strip **1846** is defined on the outer surface **1982** of the ring body **1980**, and, as described above, the grip **1848** may be utilized by a user to operate the adjustment assembly **1842**.

In use, a user may operate the controls **818** to energize the motor **814** to rotate the output shaft **850**. Because the cutting assembly **816** is secured the output shaft **850** via the drive stem **852**, rotation of the output shaft **850** causes rotation of the cutting assembly. While the motor **814** is energized, the user may advance food items into the processing chamber **826** to be cut by the rotating cutting assembly.

To adjust the cutting thickness while the cutting assembly **816** is driven by the motor **814**, the user may grasp the grip **1848** to rotate the control strip **1846**. The control strip **1046** acts on the drive gear **1970** and thereby causes the drive gear **1970** to begin rotating. The rotation of the drive gear **1970** causes the rotation of the guide gear **972**, which results in the upper sleeve **940** of the lift device **886** to rotate and translate upwardly or downwardly relative to the base **1812**. As described above, the vertical movement of the upper sleeve **940** moves the adaptor **884** and the rotating disk **832** relative to the base **1412** while the cutting blade **830** remains fixed vertically. In that way, the thickness of food items cut by the cutting assembly may be adjusted while the cutting assembly is driven by the motor **814**.

It should be appreciated that the food processor **1810** may include a locking mechanism similar to the locking mechanism **1020** described above in reference to FIGS. **23-28**, which is configured to inhibit movement of the control strip **1846** and thereby maintain the cutting assembly **816** at a particular cutting position. Additionally, it should also be appreciated that the bowl or base may include one or more locating features to guide a user in properly positioning the bowl on the base. The food processor **1810** may also include position markings that indicate the cutting thickness of the cutting assembly **816**.

Referring now to FIGS. **38-39**, another embodiment of a food processor (hereinafter food processor **2010**) is shown. The food processor **2010** includes another embodiment of a base (hereinafter base **2012**) and another embodiment of a bowl (hereinafter bowl **2020**). The food processor **2010** also includes another embodiment of a thickness adjustment assembly (hereinafter adjustment assembly **2042**) that is operable to change the thickness of cut food items produced by the food processor **2010**. To operate the adjustment assembly **2042**, a user rotates the bowl **2020** about an axis **2222** relative to the base **2012**, as described in greater detail below.

The base **2012**, like the base **812** described above in reference to FIGS. **23-28**, houses a motor **814** and a control unit. Under the control of the control unit, the motor **814** drives a cutting assembly to cut food items such as cheeses, meats, fruits, and vegetables. The cutting assembly may be, for example, the cutting assembly **816**, which was described above in reference to FIGS. **23-28**, or the cutting assembly **1216**, which was described above in reference to FIGS. **30** and **31**.

The base **2012** of the food processor **2010** includes one or more buttons, switches, dials, or other types of controls **818**. A user operates the controls **818** to control the operation of the motor **814** and hence the food processor **2010**. The motor **814** includes an output shaft **850** that is configured to be coupled to a drive stem (not shown), which is in turn configured to be secured to the cutting assembly. In that way, driving force generated by the motor **814** may be transferred to the cutting assembly. As shown in FIG. **38**, the base **2012** also includes a mounting platform **2050** configured to receive the bowl **2020** thereon, and the output shaft **850** extends upwardly from the mounting platform **2050**. The mounting platform **2050** has an outer wall **2052** that extends upwardly from a rim surface **2054** of the base **2012** and an upper surface **2056**.

As shown in FIGS. **39** and **40**, the bowl **2020** of the food processor **2010** has an inner wall **2060** that extends downwardly from an upper rim (not shown) to a bottom wall **2062**. The inner wall **2060** and the bottom wall **2062** cooperate to define part of a processing chamber **826** where food items may be processed by the cutting assembly. A removable lid, such as, for example, the lid **822** described above in reference to FIGS. **23-28**, may be secured to the bowl **2020**. Collectively, the lid **822** and the bowl **2020** cooperate to define the processing chamber **826**. The bottom wall **2062** also includes an opening **2078** sized such that the output shaft **850** and part of the adjustment assembly **2042** may extend therethrough.

The bowl **2020** also includes a lower wall **2064** that is positioned below the processing chamber **826**. The lower wall **2064** and the bottom wall **2062** define a lower chamber **2066** that is sized to receive the mounting platform **2050** of the base **2012**. The bowl **2020** has a handle **2068** that facilitates placement of the bowl **2020** on the base **2012**, and the handle **2068** is received in an opening **2070** defined in the lower wall **2064**. The handle **2068** has an arm **2072** that extends inwardly from the lower wall **2064** to an end **2074**. As shown in FIG. **40**, the end **2074** of the arm **2072** has a plurality of teeth **2076** defined thereon.

Returning to FIG. **38**, the upper surface **2056** of the mounting platform **2050** has an opening **2080** defined therein. Inner walls **2082**, **2084** extend downwardly from the opening **2080** to define a pocket **2086** in the mounting platform **2050**. The pocket **2086** is sized to receive the arm **2072** of the bowl **2020**. The mounting platform **2050** also has a track **2088** defined in the outer wall **2052**, and the track **2088** is similarly sized to receive the arm **2072**. As shown in FIG. **28**, the track **2088** is connected to the pocket **2086**, and the pocket **2086** and the track **2088** cooperate to form a slot **2090** in the mounting platform **2050**.

The thickness adjustment assembly **2042**, like the adjustment assembly **842** of FIGS. **23-28**, includes a two-piece adaptor **884** configured to be coupled to the cutting assembly and a lift device **886** supporting the adaptor **884**. The lift device **886** is operable to move the adaptor **884** upwardly and downwardly relative to the base **2012**, and, in that way, change the position of the rotating disk of the cutting

assembly relative to the cutting blade of the cutting assembly, thereby adjusting the cutting thickness.

The adjustment assembly **2042** of the food processor **2010** also includes a gear assembly **2188** positioned in the base **2012**. Similar to the gear assembly **888** described above in reference to FIGS. **23-28**, the gear assembly **2188** is configured to operate the lift device **886** to lower and raise the adaptor **884**. The bowl **2020** is configured to engage the gear assembly **2188** so that a user may change the thickness of the food items produced by the food processor **1010** while the cutting assembly is driven by the motor **814**.

The lift device **886** of the adjustment assembly **2042** includes a screw-type drive assembly that may be operated to adjust the position of the rotating disk of the cutting assembly relative to the cutting blade and to the base **812**. The screw-type drive assembly includes an internally-threaded upper sleeve **940** that threadingly engages an externally-threaded lower sleeve (not shown) such that the upper sleeve **940** may be moved upwardly or downwardly relative to the base **2012** by rotating the upper sleeve **940**.

As shown in FIG. **38**, the adaptor **884** of the adjustment assembly **2042** includes an upper shaft (not shown) that is secured to the cutting assembly and a lower shaft **892** that is configured to be torsionally secured to the upper shaft. The lower shaft **892** is rotatably coupled to the upper sleeve **940** of the lift device **886**. In that way, when the upper shaft is secured to the lower shaft **892**, the assembled adaptor **884** (and hence the cutting assembly) is permitted to rotate relative to the upper sleeve **940**. The lower shaft **892** is fixed axially relative to the upper sleeve **940** such that upward and downward movement of the upper sleeve **940** causes upward and downward movement of the lower shaft **892** of the adaptor **884**. As described above in reference to FIGS. **23-28**, when the adaptor **884** is assembled and the cutting assembly is secured thereto, the upward and downward movement of the upper sleeve **940** is thereby translated to the cutting assembly such that the rotating disk of the cutting assembly slides relative to the cutting blade to change the cutting thickness of the cutting assembly.

As shown in FIG. **41**, the adjustment assembly **2042** also includes a gear assembly **2188** that is configured to operate the lift device **886**. The base **2012** has a compartment **960**, and the gear assembly **2188** is positioned in the compartment **960**. The gear assembly **2188** includes a drive gear **2190** and a guide gear **972** that are pivotally coupled to the base **2012**. The drive gear **2190** includes a body **2192** that has a plurality of teeth **2194** defined thereon.

The guide gear **972** of the gear assembly **2188** has a body **982** configured to be rotatably coupled to the base **2012**. The body **982** of the gear **972** has a plurality of teeth **976** defined on an outer surface **980** thereof. A number of the teeth **2194** of the drive gear **2190** are interdigitated with a number of the teeth **976** of the guide gear **972** such that rotation of the drive gear **2190** causes rotation of the guide gear **972**.

As in the embodiment of FIGS. **23-28**, the upper sleeve **940** of the lift device **886** is movably coupled to the guide gear **972** such that rotation of the guide gear **972** causes rotation of the upper sleeve **940** relative to the lower sleeve **942**. As described above, the rotation of the sleeve **940** results in the sleeve **940** translating upwardly or downwardly relative to the base **2012**.

As shown in FIGS. **38-41**, the food processor **2010** also includes a locking mechanism **2200** configured to inhibit movement of the bowl **2020** relative to the base **2012** and thereby maintain the cutting assembly in a particular cutting position. In the illustrative embodiment, the locking mechanism **2200** is embodied as a detent device **2202**. As shown

in FIGS. 39 and 40, the detent device 2202 includes a pin 2204 that extends downwardly from the bottom wall 2062 of the bowl 2020 and, as shown in FIG. 38, a plurality of notches 2206 that are defined in the upper surface 2056 of the base 2012. Each notch 2206 corresponds to a preset cutting position of the cutting assembly, and the convex lower end 2208 of the pin 2204 is configured to be received in each of the notches 2206 as the bowl 2020 is rotated about the axis 2022.

In use, a user may align the arm 2072 of the bowl 2020 with the opening 2080 of the base 2012. The bowl 2020 may be advanced downward such that the arm 2072 is received in the pocket 2086 and the lower wall 2064 of the bowl 2020 is advanced into contact with the rim surface 2054 of the base 2012. When the arm 2072 is positioned in the pocket 2086, the teeth 2076 of the arm 2072 are spaced apart from and not in contact with the teeth 2194 of the drive gear 2190. The user may grasp the handle 2068 and rotate the bowl 2020 in the direction indicated by arrow 2198 so that the arm 2072 is advanced into the track 2088. As the bowl 2020 is rotated, the teeth 2076 of the arm 2072 mesh with a number of the teeth 2194 of the drive gear 2190, thereby rotating the drive gear 2190. The rotation of the drive gear 2190 causes the guide gear 972 to rotate. As described above, rotation of the guide gear 972 causes downward movement of the upper sleeve 940. When the bowl 1220 is rotated to one of the preset positions, the convex lower end 2208 of the pin 2204 is received the notch 2206 corresponding to that position, and further movement of the bowl 2020 is inhibited.

A user may operate the controls 818 to energize the motor 814 to rotate the output shaft 850. Because the cutting assembly is secured the output shaft 850 via the drive stem, rotation of the output shaft 850 causes rotation of the cutting assembly. While the motor 814 is energized, the user may advance food items into the processing chamber 826 to be cut by the rotating cutting assembly.

If the user desires to change the cutting thickness during the cutting operation, the user may lift the bowl 2020 to remove the pin 2204 from that notch 2206 and then rotate the bowl 2020 to the next position. As the bowl 2020 is rotated, the teeth 2076 of the arm 2072 mesh with a number of the teeth 2194 of the drive gear 2190, thereby rotating the drive gear 2190. The rotation of the drive gear 2190 causes the guide gear 972 to rotate. As described above, rotation of the guide gear 972 causes movement of the upper sleeve 940 upwardly or downwardly and changes the thickness of food items being processed by the food processor 2010.

Referring now to FIG. 42, another embodiment of a food processor (hereinafter food processor 2210) is shown. The food processor 2210 includes the cutting assembly 1216 and the removable lid 1228, which were described above in reference to FIGS. 30 and 31. The food processor also includes another embodiment of a base (hereinafter base 2212) and a removable bowl (hereinafter bowl 2220). The food processor 2210 includes another embodiment of a thickness adjustment assembly (hereinafter adjustment assembly 2242) that is operable to change the thickness of cut food items produced by the food processor 2010. To operate the adjustment assembly 2242, a user rotates the bowl 2220 about an axis 2222 relative to the base 2212, as described in greater detail below.

The base 2212 houses a motor 814 and a control unit (not shown). Under the control of the control unit, the motor 814 drives the cutting assembly 1216 to cut food items such as cheeses, meats, fruits, and vegetables. The bowl 2220 is rotatably coupled to the base 812. The bowl 820 has an upper rim 2224 and an inner wall 2226 that extends down-

wardly from the upper rim 2224 to a bottom wall 2228 to define part of a processing chamber 2230 where food items may be processed by the cutting assembly 1216. The removable lid 1228 is secured to the rim 2224 of the bowl 2220. In that way, the removable lid 1228 and the bowl 2220 cooperate to define the processing chamber 2230.

As shown in FIG. 42, the bowl 2220 also includes an inner wall 2232 that defines a cavity 2234 below the processing chamber 2230. An external gear 2236 is secured to the inner wall 2232 of the bowl 2220. The external gear 2236 has a plurality of teeth (not shown) defined on an inner surface (not shown).

As described above, the cutting assembly 1216 of the food processor 2210 is driven by the motor 814 to cut food items. The motor 814 includes an output shaft 850 extending upwardly from the base 2212. The output shaft 850 is coupled to a drive stem 1252, which is in turn configured to be secured to the cutting assembly 1216. As described above in reference to FIGS. 30 and 31, the cutting assembly 1216 includes a cutting blade 830 and a rotating disk 1232 configured to slide vertically relative to the cutting blade 830.

The food processor 2210 also includes a thickness adjustment assembly 2242, which is operable to move the rotating disk 1232 relative to the cutting blade 830. The adjustment assembly 2242 includes a two-piece adaptor 884, a lift device 886 supporting the adaptor 884 and the rotating disk 1232, and a gear assembly 2288 attached to the base 2212. The lift device 886 is operable to move the adaptor 884 (and hence rotating disk 1232) upwardly and downwardly relative to the base 2212 of the food processor 2210, and the gear assembly 2288 is configured to operate the lift device 886.

The lift device 886 of the adjustment assembly 2242 includes a screw-type drive assembly that may be operated to adjust the position of the rotating disk of the cutting assembly relative to the base 812. The screw-type drive assembly includes an internally-threaded upper sleeve 940 that threadingly engages an externally-threaded lower sleeve 942 such that the upper sleeve 940 may be moved upwardly or downwardly relative to the base 2212 by rotating the upper sleeve 940.

As shown in FIG. 42, the adaptor 884 of the adjustment assembly 2242 includes an upper shaft 890 that is secured to the rotating disk 1232 of the cutting assembly 1216, and a lower shaft 892 that is rotatably coupled to the upper sleeve 940 of the lift device 886. In that way, the adaptor 884 (and hence the cutting assembly) is permitted to rotate relative to the upper sleeve 940. The lower shaft 892 is fixed axially relative to the upper sleeve 940 such that upward and downward movement of the upper sleeve 940 of the lift device 886 causes upward and downward movement of the lower shaft 892 of the adaptor 884. When the adaptor 884 is assembled and the cutting assembly 1216 is secured thereto, the upward and downward movement of the upper sleeve 940 is thereby translated to the cutting assembly 1216 such that the rotating disk 1232 slides relative to the cutting blade 830 to change the cutting thickness of the cutting assembly 416.

The gear assembly 2288 of the adjustment assembly 2242 includes a guide gear 2292 that is positioned on a top surface 2294 of the base 2212. The upper sleeve 940 of the lift device 886 is movably coupled to the guide gear 2292. Like the embodiment of FIGS. 23-28, rotation of the guide gear 2292 causes rotation of the upper sleeve 940 relative to the lower sleeve 942, which results in the sleeve 940 translating upwardly or downwardly relative to the base 2212.

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The guide gear **2292** has a body **2296** rotatably coupled to the base **2212**. The body **2296** has a plurality of teeth **2298** defined on an outer surface thereof. A number of the teeth **2298** of the guide gear **2292** are interdigitated with a number of the teeth of the bowl **2220** when the bowl **2220** is positioned on the base **2212** such that rotation of the bowl **2220** causes rotation of the guide gear **2292**.

In use, a user may position the bowl **2220** over the output shaft **850** and advance the bowl **2220** into contact with the base **2212**. The teeth of the bowl **2220** mesh with the teeth **2298** of the guide gear **2292**. The user may grasp the bowl handle (not shown) and rotate the bowl **2220** about the axis **2222**. As the bowl **2220** is rotated, the guide gear **2292** is rotated. As described above, rotation of the guide gear **2292** causes downward movement of the upper sleeve **940** and hence movement of the rotating disk **1232** relative to the cutting blade **830**.

A user may operate the controls **818** to energize the motor **814** to rotate the output shaft **850**. Because the cutting assembly **1216** is secured on the output shaft **850** via the drive stem **1252**, rotation of the output shaft **850** causes rotation of the cutting assembly. While the motor **814** is energized, the user may advance food items into the processing chamber **826** to be cut by the rotating cutting assembly **1216**. While the cutting assembly **1216** is driven by the motor **814**, the user may rotate the bowl **2220** to move the rotating disk **1232** relative to the cutting blade **30**, thereby changing the cutting thickness of the cutting assembly **1216**.

It should be appreciated that the food processor **2210** or any of the food processors described above may include a locking mechanism configured to inhibit movement of the bowl relative to the base and thereby maintain the cutting assembly at a particular cutting position. It should also be appreciated that the gear assembly may include other gear arrangements to translate the rotation of the bowl into movement of the rotating disk or the cutting blade to adjust the cutting thickness of the cutting assembly.

Additionally, as described above, the adjustment assemblies may include electromechanical components such that the user may adjust the cutting thickness at the touch of a button while the cutting assembly is driven by the motor. It should therefore be appreciated that any of the embodiments described above in which the user manually adjusts the cutting thickness of the cutting assembly (e.g., the embodiments of FIGS. **23-28** and **30-42**) may be modified to include electronic means such as, for example, an electronic motor or other electromechanical device, that change the cutting thickness of the cutting assembly in response to the user pressing a button or interacting with another control. In such embodiments, a motor may provide a force which acts on the adjustment assemblies described above to change the cutting thickness. As described above, it should be appreciated that the addition of such electronic components may require additional controls or buttons, such as, for example, a keypad, to control the operation of the additional electronic components.

There are a plurality of advantages of the present disclosure arising from the various features of the method, apparatus, and system described herein. It will be noted that alternative embodiments of the method, apparatus, and system of the present disclosure may not include all of the features described yet still benefit from at least some of the advantages of such features. Those of ordinary skill in the art may readily devise their own implementations of the method, apparatus, and system that incorporate one or more

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of the features of the present invention and fall within the spirit and scope of the present disclosure as defined by the appended claims.

What is claimed is:

1. A food processor comprising:

a base having a motor positioned therein;

a bowl removably coupled to the base;

a lid removably coupled to the bowl so as to define a processing chamber, the lid having a feed tube that opens into the bowl;

a cutting assembly positioned in the processing chamber and driven by the motor to cut food items advanced through the feed tube, the cutting assembly including a rotating disk and a blade having a cutting edge that is spaced an adjustable vertical distance from an upper surface of the rotating disk, the cutting edge being positionable between a plurality of user-selected cutting positions relative to the upper surface of the rotating disk to adjust the vertical distance to produce cut food items of varying thicknesses corresponding to vertical distances; and

an adjustment assembly comprising (i) a gear assembly positioned in the base, wherein the gear assembly is configured to move the cutting edge between the plurality of cutting positions to adjust the vertical distance while the cutting assembly is driven by the motor, and (ii) a user-operated control device configured to operate the gear assembly to move the cutting assembly between the plurality of cutting positions to adjust the vertical distance, and the thickness of cut food items.

2. The food processor of claim 1, wherein:

the user-operated control device comprises a thumbwheel.

3. The food processor of claim 2, wherein:

the adjustment assembly includes a sleeve rotatively coupled to the base; and

wherein movement of the thumbwheel operates the gear assembly and rotates the sleeve.

4. The food processor of claim 3, wherein:

rotation of the sleeve in a first direction causes upward movement of the upper surface of the rotating disk relative to the cutting edge, and rotation of the sleeve in a second direction causes downward movement of the upper surface of the rotating disk relative to the cutting edge.

5. The food processor of claim 4, wherein:

the gear assembly comprises:

(i) a first gear including a first plurality of teeth, the first gear being moveably coupled to the sleeve such that rotation of the first gear causes rotation of the sleeve, and

(ii) a second gear including a second plurality of teeth interdigitated with the first plurality of teeth such that rotation of the second gear causes rotation of the first gear.

6. The food processor of claim 5, wherein:

the first gear is a worm gear.

7. The food processor of claim 5, wherein:

the user-operated control device includes a grip formed on the second gear, the grip being operable by a user to rotate the second gear.

8. The food processor of claim 5, wherein:

the user-operated control device includes a ring having a third plurality of teeth defined on an inner surface, the third plurality of teeth being interdigitated with a number of the second plurality of teeth such that rotation of the ring causes rotation of the second gear.

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9. The food processor of claim 8, wherein:  
the ring has a grip formed thereon operable by a user to rotate the ring;  
the bowl includes a lower wall and the ring is rotatively coupled to the lower wall of the bowl.
10. The food processor of claim 1, wherein:  
the user-operated control device includes a lever extending outwardly from the base and movable relative to the base, the lever being coupled to the gear assembly such that movement of the lever relative to the base causes the gear assembly to rotate the sleeve.
11. The food processor of claim 1, wherein:  
the user-operated control device includes a shaft extending outwardly from the base and a control knob coupled to the shaft, wherein rotation of the control knob causes the cutting edge to move between the plurality of user-selected cutting positions to adjust the vertical distance.
12. A food processor comprising:  
a base having a motor positioned therein;  
a removable bowl coupled to the base;  
a removable lid coupled to the bowl so as to define a processing chamber having an upper compartment and a lower compartment, the lid having a feed tube that opens into the bowl;  
a cutting blade positioned in the bowl and driven by the motor to cut food items advanced through the feed tube;  
a rotating disk having an upper surface, wherein at least a portion of the upper surface is movable relative to the cutting blade to adjust the vertical distance therebetween, and wherein the upper surface and the cutting blade are configured such that food items inserted through the feed tube are urged into contact with the upper surface while being cut by the cutting blade, and wherein the thickness of the pieces of food items being cut is determined by the vertical distance between the upper surface and cutting blade, and wherein the rotating disk is disposed between the upper compartment and a lower compartment of the processing chamber; and  
an adjustment assembly operable to move at least the movable portion of the upper surface of the rotating disk relative to the cutting blade to adjust the vertical distance therebetween and the thickness of pieces of food being cut, the adjustment assembly including a user-operated control device that is movable by a user to adjust the vertical distance, and wherein the adjustment assembly is configured to retain at least the movable portion of the upper surface of the rotating disk at any one of a plurality of non-equal positions relative to the cutting blade, and to prevent upward and downward movement of at least the movable portion of the rotating disk at any one of the plurality of non-equal positions relative to the cutting blade while the food processor is being used to cut food items.
13. The food processor of claim 12, including:  
a ramp positioned below the cutting blade to guide food items from the upper compartment into the lower compartment.
14. The food processor of claim 13, wherein:  
the upper surface of the rotating disk is upwardly and downwardly movable relative to the cutting blade.
15. The food processor of claim 12, wherein:  
the user-operated control device is positioned above the rotating disk.

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16. The food processor of claim 12, wherein:  
the user-operated control device is positioned on the base.
17. The food processor of claim 16, wherein:  
the user-operated control device comprises an external lever that is movable to adjust the distance.
18. The food processor of claim 12, wherein:  
the user-operated control device includes (i) an internally-threaded control knob coupled to the blade and (ii) an externally threaded sleeve coupled to the rotating disk and positioned in the control knob, and wherein rotation of the control knob in a first direction causes upward movement of the rotating disk, and rotation of the control knob in a second direction causes downward movement of the rotating disk.
19. The food processor of claim 12, wherein:  
the user-operated control device comprises a user-operated pin that is movable between (i) a first position in which the rotating disk is prevented from moving upwardly and downwardly relative to the cutting blade, and (ii) a second position in which the rotating disk is permitted to move upwardly and downwardly relative to the cutting blade, and wherein the rotating disk includes a sleeve extending downwardly from a lower surface thereof, the sidewall of the sleeve including a first plurality of teeth, and wherein an outer surface of the pin has a second plurality of teeth extending therefrom and wherein a number of the first plurality of teeth are engaged with the second plurality of teeth when the user-operated pin is in the first position.
20. The food processor of claim 12, wherein:  
the adjustment assembly is positioned in the base, the adjustment assembly including a screw-type drive assembly comprising an externally-threaded first sleeve and an internally threaded second sleeve positioned over the first sleeve;  
the rotating member comprises a rotating disk that is supported by the second sleeve;  
rotation of the second sleeve in a first direction causes upward movement of the second sleeve and the rotating disk, and rotating of the second sleeve in a second direction causes downward movement of the second sleeve and the rotating disk;  
the adjustment assembly further comprises a gear assembly positioned in the base and coupled to the second sleeve, the gear assembly being configured to rotate the second sleeve relative to the first sleeve, the gear assembly including first and second gears, the first gear having a first plurality of teeth engaging a second plurality of teeth of the second gear;  
the user-operated control device includes a lever extending outwardly from the base and positionable between a plurality of adjustment positions relative to the base, the lever being coupled to the second gear such that movement of the lever between the plurality of adjustment positions causes rotation of the second sleeve relative to the first sleeve to move the cutting assembly between the plurality of cutting positions; and including:  
a locking mechanism to inhibit movement of the lever.
21. The food processor of claim 12, wherein:  
the adjustment assembly comprises a gear assembly comprising first and second gears having first and second pluralities of teeth, respectively, wherein the gear assembly is operated by the user-operated control device;  
and wherein the user-operated control device is selected from a group consisting of (i) a control knob having a grip and a shaft extending inwardly from the control



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knob into the base, (ii) a grip formed on the second gear, (iii) a ring having a grip and a plurality of teeth defined on an inner surface of the ring that engage the second plurality of teeth, and (iv) a thumbwheel positioned in a slot defined in the base.

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